Metal Finishing

POLISHING AND BUFFING · BARREL FINISHING · CLEANING
PLATING · ANODIZING · RUST PROOFING · LACQUERING & ENAMELING

NOVEMBER, 1960

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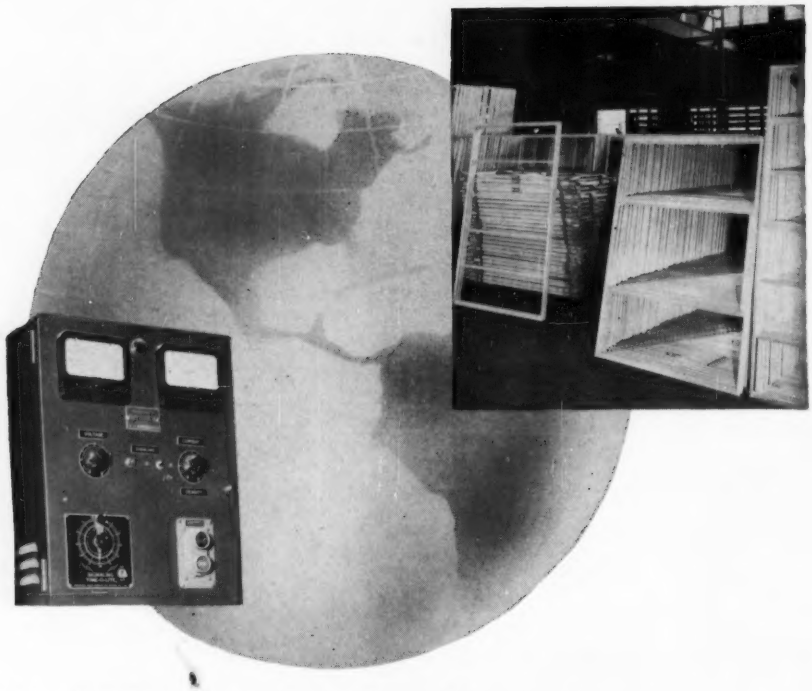
Read and pass on—



"There's a world of difference in Anodizing when you have Automatic Current Control" . . .

. . . says John Gurniak of

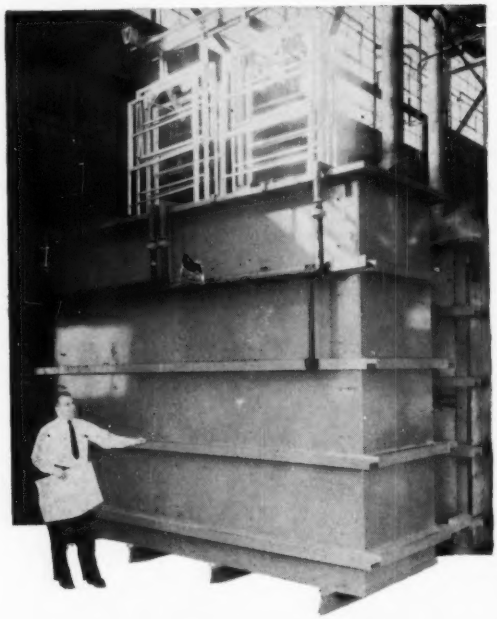
MICHAEL FLYNN MFG. CO., PA.

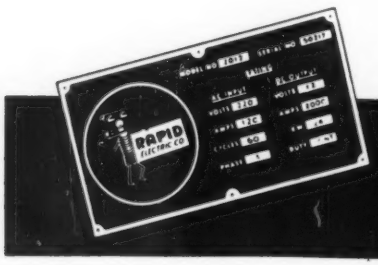
"and that big difference is the accuracy and simplicity in which a pre-determined film thickness can be controlled."

"We chose RAPID ELECTRIC'S Automatic Current Control rectifiers to eliminate the problem of estimating current densities with each load change. One setting, and the rectifier automatically maintains a constant current density per square foot of work."

"It's that easy".

"Once more, with the possibility of over-current virtually eliminated, MICHAEL FLYNN'S high standard of quality is assured."





THE NAMEPLATE THAT MEANS *"More Power to You!"*

RAPID ELECTRIC COMPANY

12838 Fenkell Avenue • Detroit 27, Mich. • Diamond 1-8537

2881 Middletown Road • New York 61, N. Y. • TAlmadge 8-2200

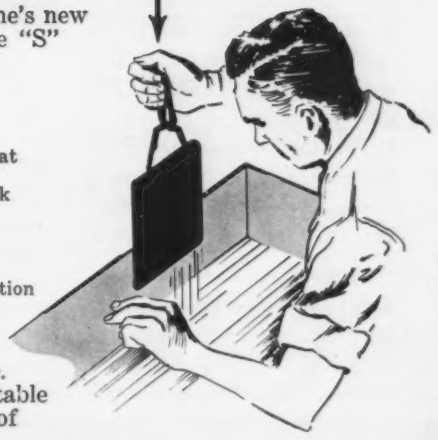
red smut?

not on this blackened steel

No red smut forms on any iron and steel parts when Enthone's new Ebonol Additive "S" is used in blackening baths. Additive "S" effectively holds in suspension dissolved iron and copper, preventing deposition of red smut on the work.

ADVANTAGES OF ADDITIVE "S" ARE:

- Eliminates red smut
- Produces deeper black
- Shortens blackening time
- Permits lower blackening temperature
- Increases production
- Improves ability of present baths to coat hard-to-blacken alloys
- Maintains corrosion resistance of black oxide coating
- Permits blackening of copper-brazed steel parts
- Costs less than other methods of controlling iron and copper contamination



Ebonol Additive "S" is used in all steel blackening baths which contain oxidizing agents and caustic soda and produce a coating in the 285°-305°F temperature range. It is a concentrated solution of blended complexing agents stable to oxidizing agents, high alkalinity and high temperatures of blackening baths.

Visual observation of the work is the only control required. At the first sign of red smut, add 1-2 ounces of Ebonol Additive "S" to each gallon of solution.

For complete information, write to Enthone, Inc., 442 Elm Street, New Haven 8, Conn.

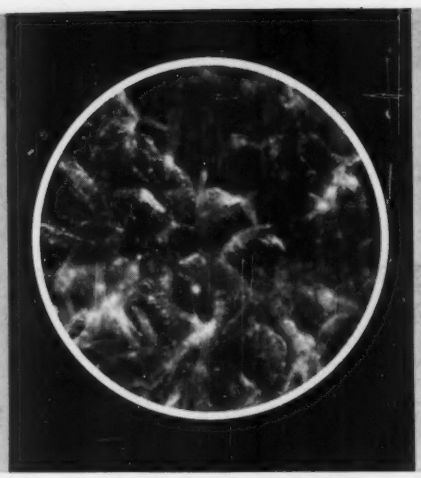
ASARCO

ANOTHER PRODUCT OF Enthonics RESEARCH

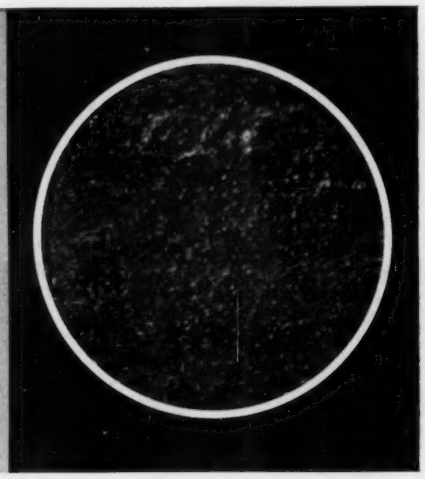
ENTHONE

A Subsidiary of American Smelting and Refining Company

Photomicrograph, 300x magnification, shows coating structure produced by conventional phosphating treatment.



Fine-grained coating, shown in photomicrograph at 300x magnification, produced on steel by Bonderite 890.

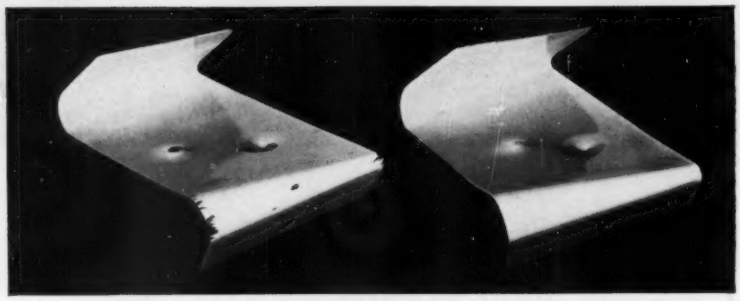


Finer Parker phosphate coating improves adhesion of new "hard" paints

Here is a Bonderite developed to meet the exacting requirements of the new "hard" paints —the epon and acrylic finishes so popular with manufacturers and their customers.

Bonderite 890 forms a microcrystalline coating on steel. It is so finely crystalline that it is commonly referred to in industry as amorphous. The coating withstands an extraordinary amount of flexing of the metal underneath, with little shearing or dusting even under severe bending or denting.

Finishes applied over Bonderite 890's fine grained coating gain greater adherence and flexibility. Epons and acrylics withstand deformation without signs of failure.



Steel panels, finished with an acrylic enamel and bent on a conical mandrel. Unretouched photos show paint flaking over conventional phosphate treatment (left), and excellent paint retention over Bonderite 890 (right).

FINE RESULTS AFTER HEAVY-DUTY CLEANERS

Regardless of the cleaning method used, Bonderite 890 coatings are uniformly hard and dense. This removes all restrictions on the utilization of medium and heavy-duty alkaline cleaners to handle heavy dirt, grease and soil. You get high quality paint base coatings after any type of cleaner, when you use this specially developed Bonderite.

WANT MORE INFORMATION?

The Parker representative near you can give you details on Bonderite 890 and the benefits it may bring to your plant and your production. Call him in, or write Parker, Detroit.

Parker Rust Proof Company
2167 E. MILWAUKEE, DETROIT 11, MICHIGAN

Since 1914— leader in the field

BONDERITE corrosion resistant paint base • BONDERITE and BONDERLUBE aids in cold forming of metals • PARCO COMPOUND rust resistant • PARCO LUBRITE—wear resistant for friction surfaces • TROPICAL—heavy duty maintenance paints since 1883

*Bonderite, Bonderized, Bonderlube, Parco, Parco Lubrite—Reg. U.S. Pat. Off.

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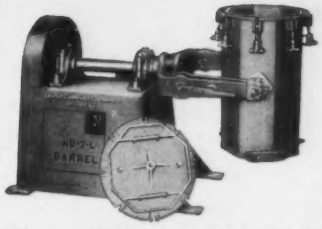
62 . . . . for 62 years!

Manufacturing Reliance Plating, Polishing Equipment, Supplies for Better and More Profitable Metal Finishing

Chas. F. L'Hommedieu & Sons Co.

No. 18 — VARIABLE SPEED POLISHING LATHE

Independent spindles—each with separate patented Variable Speed Drive and controls — ball-bearing throughout. Powered by two up to 25 H.P. motors. Adopted by leading manufacturers as standard equipment.

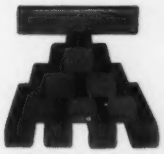


TYPE L — DOUBLE ACTION BARREL
For ABRASIVE TUMBLING or BALL BURNISHING

The cylinder can be operated at an angle for producing a double tumbling action—thus producing a better and more uniform finish in a much shorter time.

Longer pieces finished more uniformly and without bending.

RELIANCE KUL-KUT BUFFS
FOR FAST CUTTING



RELIANCE EXTRUDED COMPOSITIONS
STANDARD SIZE
2 x 2 x 10"

THEY CUT • THEY CLEAN • THEY COLOR

- **DURABILITY**
- **PRODUCTION**
- **ECONOMY**
- **EFFICIENCY**

THE ANSWER TO INCREASED PRODUCTION AT LOWER COST!

Manufacturers of Metal Finishing Equipment and Supplies

Chas. F. L'Hommedieu & Sons Co.

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4521 Ogden Ave., Chicago 23, Illinois

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Newark, N. J.

W. R. Shields Co.
Detroit, Mich.

Branches:
Cleveland & Los Angeles

All HARSHAW Nickel and Copper Plating Processes Operate Successfully with Either

CATHODE MOVEMENT, OR AIR AGITATION!

Harshaw Nubrite Bright Nickel
Harshaw Perglow-(Airglow) Bright Nickel
Harshaw Perflow Semi-Bright Nickel
Harshaw Perflow-Perglow Duplex Nickel
Harshaw Cynorex Cyanide Bright Copper
Harshaw Cuprex Acid Bright Copper

All Harshaw processes have been highly successful in their operation with mechanical agitation. Where particular conditions have dictated the need for Air Agitation, Harshaw processes are operated very effectively with beneficial results. If your requirements indicate that Air Agitation will benefit you, Harshaw is prepared to offer a suitable process.

The HARSHAW Chemical Company

1945 EAST 97th STREET • CLEVELAND 6, OHIO

Chicago 32, Ill. • Cincinnati 13, Ohio • Cleveland 6, Ohio • Detroit 28, Mich. Houston 11, Texas • Los Angeles 22, Calif. • Philadelphia 48, Pa. • Pittsburgh 22, Pa. • Hastings-On-Hudson 6, N. Y.

WE MAKE CORROSION RESISTANT EXHAUST SYSTEMS

- **Special formulae REINFORCED PLASTICS**
- **Custom engineering to meet special requirements**
- **Installation by INDUST engineers**
- **Lower costs, lower maintenance**

Custom engineered to meet your special requirements for resistance to corrosive acids or alkalies, high temperatures and structural strength.

Standard sizes of reinforced plastic hoods, tanks, ducts, elbows, stacks and piping are stocked for spot shipment.

Write for complete information.

INDUST

4025 BERGEN TURNPIKE. NORTH BERGEN. N. J.

CORROSION RESISTANT VENTILATING, DUST CONTROL AND EXHAUST SYSTEMS ENGINEERED AND INSTALLED ANYWHERE.

Oakite offers a

metal-matched

For the complete answer to better plating

ask Oakite

OVER 50 YEARS CLEANING EXPERIENCE • OVER 250 FIELD SERVICE MEN • OVER 160 MATERIALS

complete line of materials for

ELECTROCLEANING

. . . improves the cleaning
. . . improves the plated-work

There are Oakite electrocleaners to meet the special requirements of all the usual basis metals being plated, and the soils generally left on the parts during fabrication operations.

Matched to the work, each electrocleaner does the job with remarkable efficiency and surprising economy. Service results show it. Users find that solutions have long life. Operating problems are at a minimum. Most importantly, a metal-matched electrocleaner assures a brighter and perfectly adhering plated finish.

TWO-IN-ONE CLEANING OF STEEL

Oakite 190 does double duty. A *chelated* detergent for anodic or periodic reverse current use, it removes smut, heat scale and rust bloom that normally need extra treatment. At the same time, its powerful alkaline detergency gets rid of oil films and shop soil. Such cleaning insures fewer plating rejects, and can in many cases eliminate an entire operating step.

CLEANING OF COPPER WITHOUT TARNISH

Oakite 191 gives fast, thorough electrocleaning action on brass and other copper alloys, while protecting against tarnish . . . especially in reverse current cleaning. Shop soils, smuts, light buffing compounds disappear quickly. For heavily soiled parts, the solution also serves as a non-tarnishing pre-soak.

FEWER REJECTS FOR ZINC DIE CASTINGS

Oakite 195 electrocleans without etching or discoloring buffed zinc base die castings . . . also works well with lead, brittania metal, steel and brass. Used with direct, reverse or periodic reverse current, it removes soils safely yet thoroughly . . . assuring a brighter chromium luster. Many users of this new cleaner have reported no rejects due to poor electrocleaning for the first time in their experience.

Ask Oakite to detail what's in store for you when you match these materials to your work. Write Oakite Products, Inc., 40 Rector Street, New York 6, N. Y.

it PAYS to ask . . . **OAKITE**

over 50 *years' leadership in industrial cleaning* — *Est. 1909* — SCIENCE

Media-matched compounds offer better barrel finishing

A good match of compound to the job means clean and efficient media . . . faster cutting down, deburring . . . and proper lubrication for smooth burnishing. Oakite can match your needs with compounds for fine finishes, tight tolerances - for hard or soft water. Send for Bulletin F-9339.

Stop spotting, add sparkle with Oakite Rinsite®

After plating and barrel finishing, adding a little Rinsite to rinse water, helps cut water spotting and staining. It "thins" the rinse, makes it drain faster. It also leaves a thin, non-oily, invisible film that adds sparkle and indoor rust protection to plated parts. Send for Bulletin F-9822.

H-VW-M
SUPERLUME

THE PREMIUM BRIGHT NICKEL BATH

H-VW-M

Progress in metal finishing through advanced processes • equipment

we admit it
There may be other baths as bright as H-VW-M Superlume

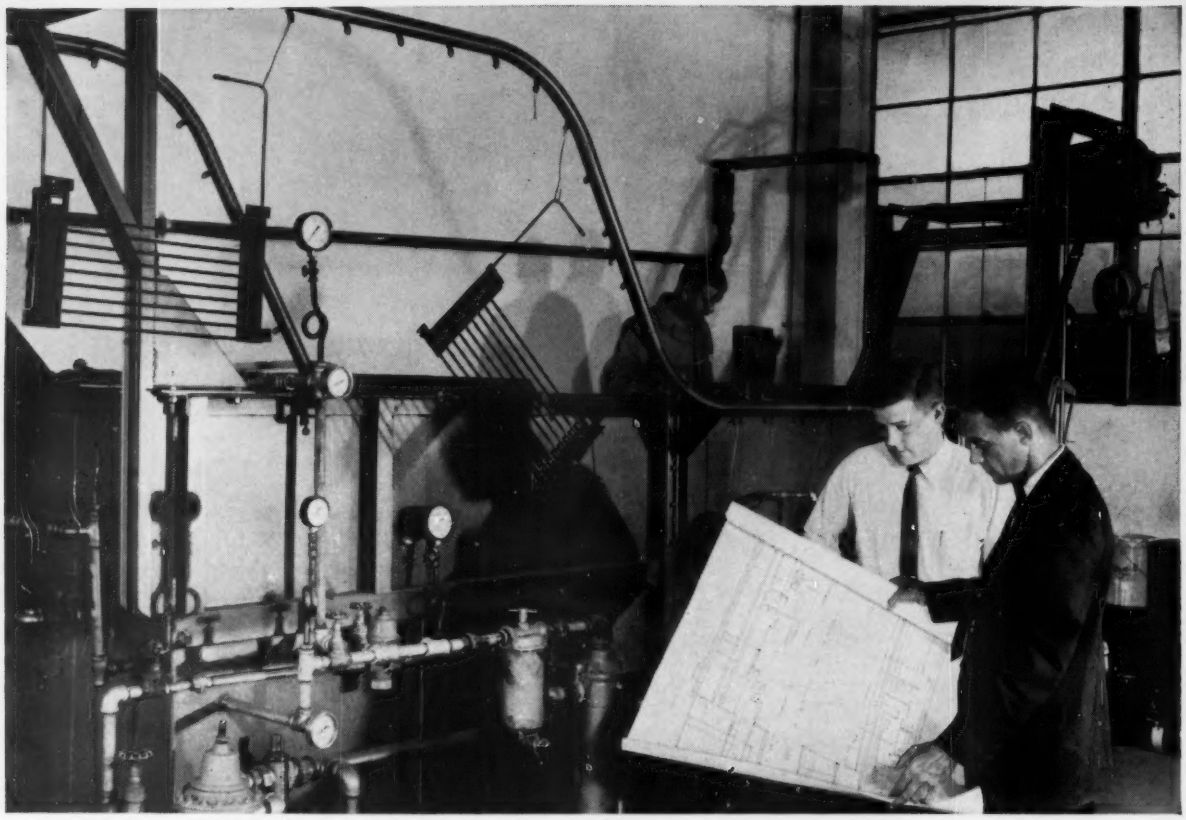
But

SUPERLUME
IS THE MOST DUCTILE AT HIGHEST LEVELLING
SUPERLUME
LEVELS BEST

Sure, it costs a little more than conventional bright baths—but no more than other baths that are almost as good as fast plating Superlume. Why not get the best! Write or call for full details.

Hanson-Van Winkle-Munning Company, Marawan, New Jersey • Offices in Principal Cities
Alert Supply Company is H-VW-M in the West • Los Angeles • San Francisco

DU PONT TRICLENE® TRICHLOR&THYLENE FINISHING NEWS



This unit demonstrates nonflammable painting process to visitors at the Chicago Plant of G. S. Blakeslee & Company. Among its other functions are: painting of sample parts for prospective machine purchasers and checking out improved design features for construction of new units.

Now another metal fabricator selects "Triclene" Painting—

TRICHLORETHYLENE

Several production units already installed... still more in design stage

A large manufacturer of lighting fixtures, after a successful demonstration of painting his product by the "Triclene" method, recently installed a unit of his own. Careful consideration was given other methods, but "Triclene" Painting won out for its space-saving advantage and inherent safety.

Eleven other manufacturers are now using "Triclene" Painting Systems in production operations. Scores of progressive metal fabricators across the country are making detailed evaluations to apply cost-cutting "Triclene" Painting to their operations.

The complete three-stage "Triclene" Finishing System—Degreasing . . . Phosphatizing . . . Painting—introduced last year, met with immediate success. One of the first to adopt it was a large automotive manufacturer (photo at right).

If you are considering expansion or replacement of your present finishing operation, call Du Pont for more information and help in evaluating "Triclene" Finishing.

"TRICLENE" Finishing is a revolutionary new way to finish metals. Clean, phosphatize and dip or spray paint continuously in a single medium of nonflammable "Triclene" trichlorethylene. Use processes singly or in combination to suit any metal finishing need.

"TRICLENE" PAINTING offers major advantages

1. Low investment: Often eliminates baking ovens; no drip pans needed. Fewer steps mean in-process inventory and conveyor length can be reduced by over 50%.

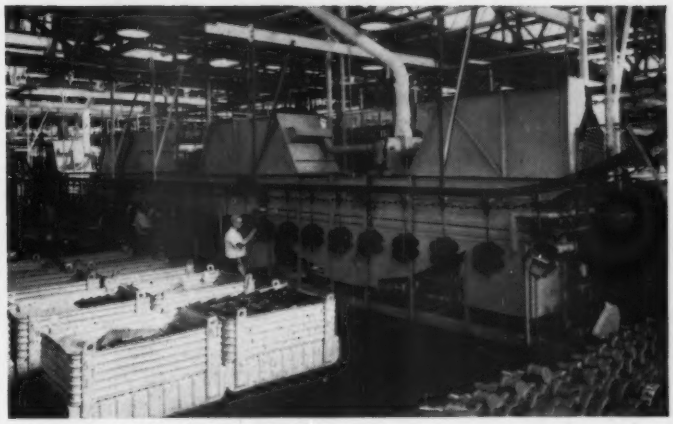
2. Economy: Operating costs reduced by as much as 30% through overspray re-use and recovery of most of the nonflammable "Triclene" thinner.

3. Reduced plant space: "Triclene" Painting can be done in less than one-half the space usually needed, as fewer steps are required.

4. Nonflammable: Increases safety. Fire hazards minimized. Insurance rates are often lower. Elimination of costly fire protection equipment.

5. Versatile: Dip or spray-in-vapor cycles can be selected. Combines readily with "Triclene" Vapor Degreasing, Phosphatizing Processes.

DU PONT
REG. U. S. PAT. OFF.
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY



Finishing line in automobile plant includes complete 3-stage "Triclene" Vapor Degreasing, Phosphatizing and Painting units. Turns out 2,400 finished parts per hour. Operating since 1959, it's one of the first installed. Unit requires only 65 linear ft. in comparision with 150 ft. needed for conventional system.

If you want to evaluate a "Triclene" process for your operation, a Du Pont technical representative will call at your convenience. He can assist you by using our exclusive cost analysis procedure, which will help you determine quickly the savings these processes can bring to your operation. Just fill out and mail coupon below to:

E. I. du Pont de Nemours & Co. (Inc.)
Electrochemicals Department—Chlorine Products Division
Wilmington 98, Delaware

I'm interested in evaluating Du Pont "Triclene" Finishing for

☐ CLEANING ☐ PHOSPHATIZING ☐ PAINTING

☐ I would like technical literature describing these processes.

☐ Our Company would consider replacement of existing equipment if we can be shown economic justification. Please send me your Finishing Data Sheet.

☐ We have an immediate need for new finishing equipment to be installed by _____ (target date)

Please have your representative contact me.

Name _____ Position _____

Firm _____

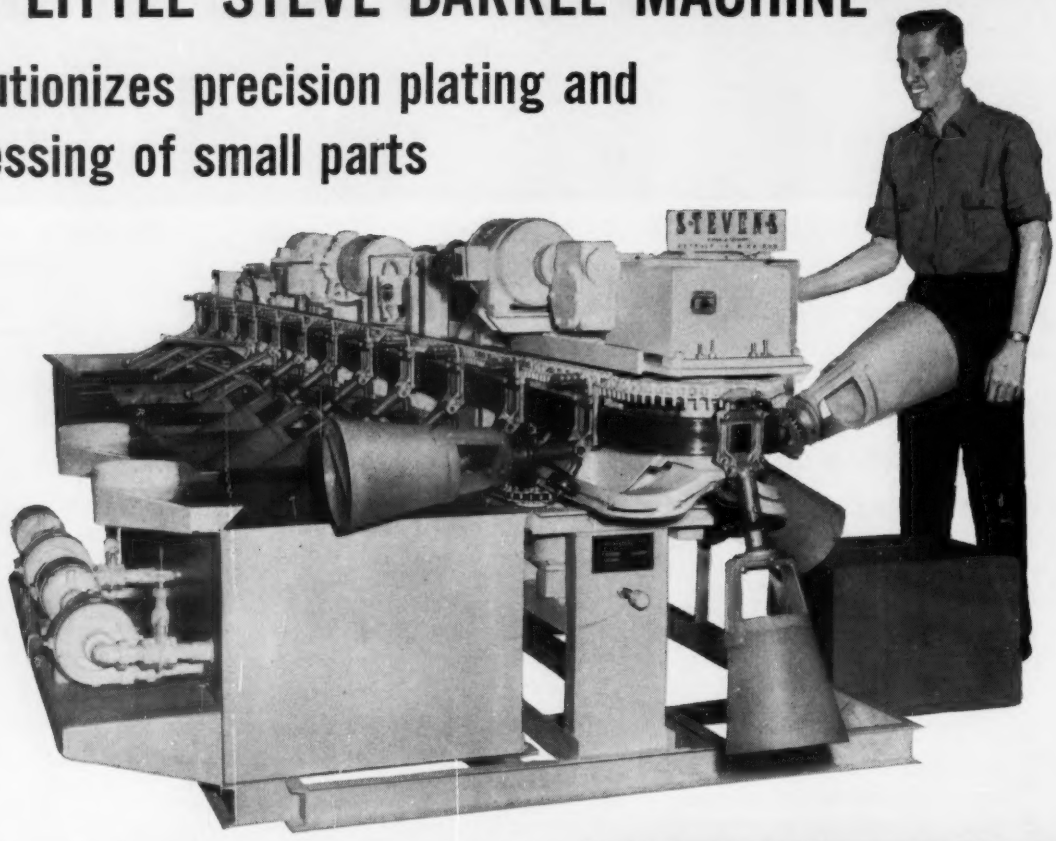
Address _____

City _____ Zone _____ State _____

V-11

NEW LITTLE STEVE BARREL MACHINE

revolutionizes precision plating and processing of small parts



Completely automatic, extremely compact, mechanically flexible, inexpensive to buy, install, maintain.

Meet the newest member of the famous Little Steve family of automatic plating and processing machines. It is small . . . only 4 feet high by 6 feet wide . . . not much higher or wider than your desk. Designed for use in your integrated operations, it incorporates features that meet today's rigid manufacturers' specifications. For example, this new Little Steve provides: • **precision plating on an automatic basis** • **low ceiling height and light floor load** • **designed for integrated process manufacturing** • **oblique barrels that require no lids** • **automatic loading and unloading** • **minimum solution and anode requirements.**

PLUS many more of the exclusive features that are part of every dependable, long-lasting, efficient Stevens plating and processing machine.

This exclusive selective "skip track" feature permits elimination or addition of any processing step. Note "no lid" barrels, easy accessibility of mechanism to operator standing on the floor.

Write today for complete information on this processing profit-builder.

frederic b. **STEVENS,** inc.

DETROIT 16, MICH.

BUFFALO CHICAGO DETROIT CLEVELAND
DAYTON NEW HAVEN INDIANAPOLIS SPRINGFIELD (OHIO)

Two New Heavy Duty Portable Filters by Industrial

CORROSION RESISTANT

Note these features:

Chamber and Cover: Steel, vulcanized rubber lining.

Filter Element: Non-woven resin impregnated fabric, molded into epoxy-phenolic ends.

Hose: Three ply, durable, acid resistant. Plastic or Hastelloy fittings.

Pump: Vulcanized, rubber-lined steel chamber. Carpenter 20 Shaft, proven mechanical seal; carbon and ceramic components.

1200 GPH

EASY TO CLEAN
Flip-top cover lifts off. Pull-out cartridge can be replaced or rinsed and reused in seconds.

100% PORTABLE
Mounted on two 8" dia. wheels. Full swivel rear coaster insures complete ease of movement.

COMPACT
Is complete filtration *system:* suction and discharge hose, ball check foot valve strainer; motor with thermal overload starter, filter element(s) and pump . . . yet requires only 6 sq. ft. of floor area. You simply plug it in . . . and start filtering, anywhere.

WORKHORSE OF THE INDUSTRY

Now you can eliminate the time and expense of bothersome repiping and the need and equipment for separate plating solution filtering stations.

The new type 118 *heavy duty* Industrial filters are rugged, but compact; low in cost but typically *Industrial*-engineered and rubber-lined throughout for corrosion resistance. The heavy duty *Industrial* pump is of the same long proven design employed in hundreds of *Industrial* filters now in plating service.

Look at the features . . . look at the specs . . . look at the *work* capacity. You can get this complete, proven-dependable filtration system in but six *portable* square feet of work area.

WRITE FOR BULLETIN 118.

TWO MODELS AVAILABLE
Single tube 600 gph capacity, is convertible to double tube 1200 gph capacity model shown above.

600 GPH

CHECK THE SPECS:

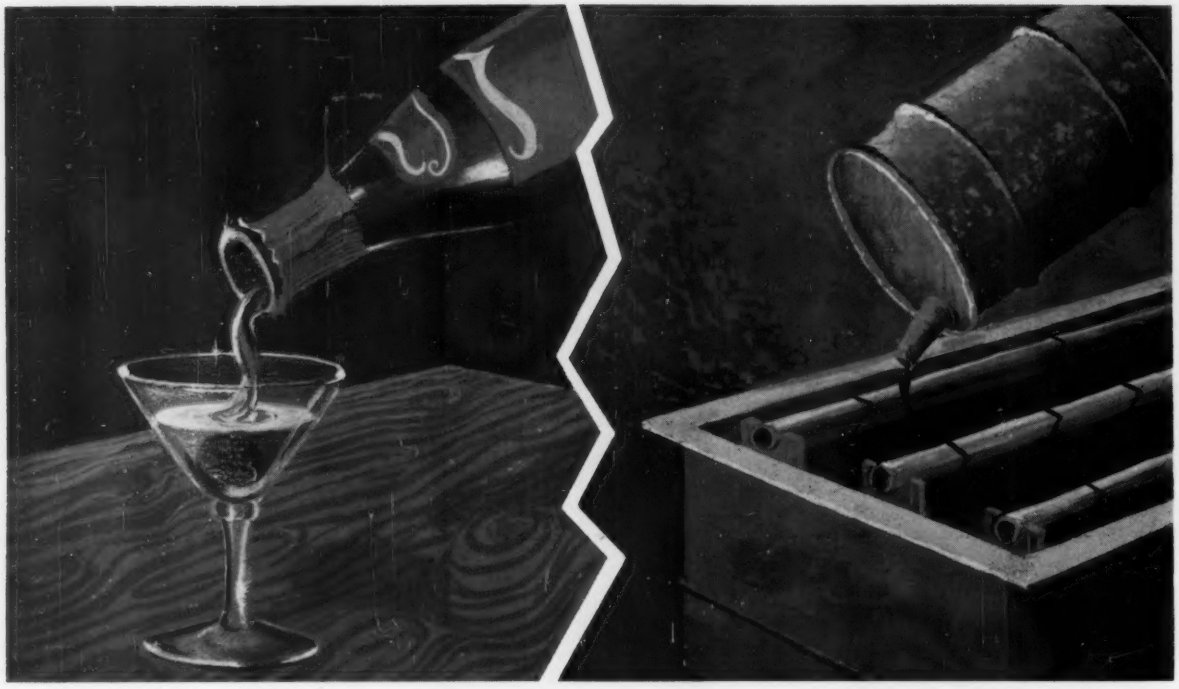
- 600 and 1200 gph capacity
- 15 and 30 sq. ft. filtration area
- Temperatures to 170° F.
- Unit 50 P.S.I.G. operating pressure
- Fully proven in plating use

INDUSTRIAL FILTER & PUMP MFG. CO.
5906 Ogden Avenue, Cicero 50, Illinois

INDUSTRIAL

P-659

ROHCO® SUPPLIES THE BRIGHT ZINC MAKINGS



As easy to use as a cocktail mix! Just add a little ROHCO Zinc Brightener to your conventional zinc plating bath . . . and just that easy you get bright chrome-like zinc at only ½% more than the cost of ordinary zinc plating!

ROHCO 102 BARREL

For 3-D depth in a mirror-like finish. Exhibits high covering power that puts substantial thickness of deposit in recesses usually unplated. Your customer will notice the difference, too.

ROHCO 503 STILL OR BARREL

Gives jewel-like bright zinc deposits with minimum effort or expense. Ideal for large tanks or where one brightener is desired for all bright zinc baths.

With the mounting demand for bright zinc plating why not spare yourself the trouble and expense of trial and error? Why not use ROHCO Bright Zinc "makings" for consistent and dependable results? Call your ROHCO Representative to arrange for an early trial . . .

ROHCO

Nationwide Stockpoints

R. O. HULL & COMPANY, INC.

1301 Parsons Court • Rocky River 16, Ohio

The RIGHT START . . . a BETTER FINISH

How can you be SURE that your Tank Linings are MATCHED TO YOUR NEEDS?

Tank lining failures can be mighty expensive in terms of ruined tanks and disrupted production schedules. That's why low cost linings sometimes prove to be the most expensive in the long run.

On the other hand, the extra money spent for protection that's not needed would be better invested elsewhere in the plant.

Selection of the proper tank lining material is frequently a confusing job for the man who's not an expert. The best course is to follow two simple, logical rules:

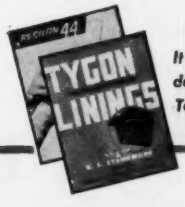
1. ***Draw on the experience of a tank lining specialist.*** One of The U. S. Stoneware Company's fully experienced tank lining engineers . . . who works day-in and day-out with tank lining problems of all types . . . will be pleased to analyze your application; weigh such variables as operating temperatures, corrosive conditions, abrasion resistance requirements, tank construction, and the like; and recommend the one tank lining material that will be best for your job — all without cost or obligation.

2. ***Work out your needs with a firm offering a full line of tank lining materials.*** Whatever your tank lining problem, The U. S. Stoneware Company produces a material that *exactly* fits your needs: TYGON® modified polyvinyl chloride extruded sheet lining, providing outstanding chemical resistance at temperatures up to 165° F.; KEL-F* trifluorochlorethylene plastic, completely inert to corrosives of all types up to 350° F. (and higher with acid brick oversheathing); PENTON** chlorinated polyether extruded lining, resistant to all alkalies and acids except fuming nitric and fuming sulfuric, at elevated operating temperatures in the range between polyvinyl chloride and the fluorocarbons; RESILON depolymerized rubber-and-resin-based thermoplastic, available either plain or fiberglass-reinforced; ACIKOTE synthetic resin baked-on coating; and others with more specialized applications.

257-G

If you'd like help on a lining problem, simply outline your operation in a letter to The U. S. Stoneware Company. A "U. S." Tank Lining Specialist will be glad to make suggestions and recommendations without cost or obligation.

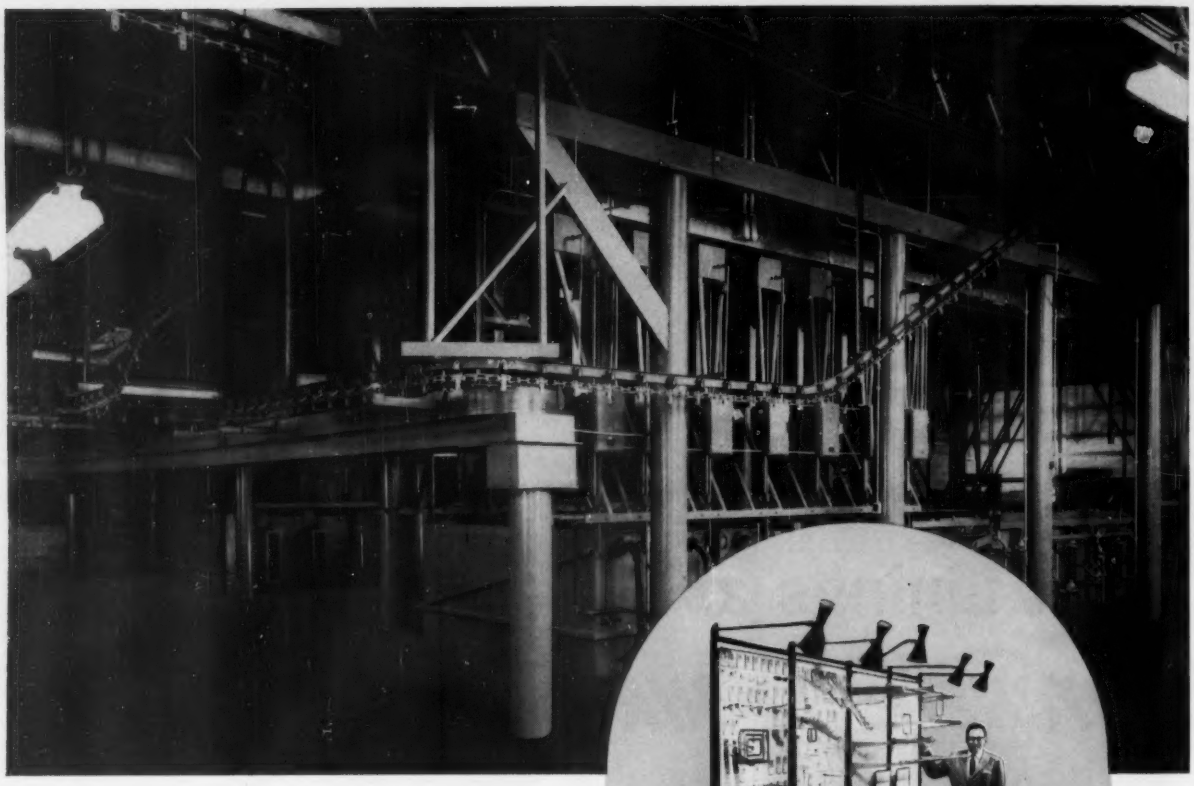
*Registered Trade Mark, 3M Co.
**Registered Trade Mark, Hercules Powder Co.



It will pay you to investigate! Write today for complete information on "U.S." Tank Linings!

PROCESS EQUIPMENT DIVISION

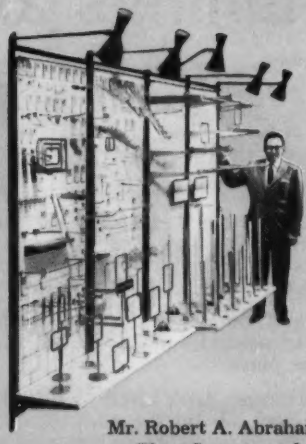
U. S. STONEWARE
AKRON 9, OHIO



how CROWN "MP" increased production and efficiency at REFLECTOR HARDWARE*

The Crown "M-P" is the most versatile automatic processing machine to be found. It is not unusual for several dissimilar jobs to be in process simultaneously . . . for example, two or three different metals can be plated in racks or barrels at two different voltages. The "M-P" handles an astonishing range of sizes and weights . . . parts from ¼-inch to 40-feet; from fractions of an ounce to 1½-tons can be processed at each station. The machine illustrated processes over 5000 *different items.*

The key to "M-P versatility is a control system far in advance of any similar equipment. If you have a continuous dipping process, find out what Crown automation can do for you . . . write for Bulletin "M-P" today!



Mr. Robert A. Abrahamson,
Plant Superintendent
REFLECTOR HARDWARE CORPORATION

says: "With modern automation of our nickel, chrome and cadmium processing, we are able to monitor production to keep up with our tight delivery schedule. The Crown "M-P" has also improved quality, speeded production and cut costs . . . it all adds up to a general efficiency gain that makes this machine a very profitable investment."

*WORLD'S LARGEST MANUFACTURER OF METAL MERCHANDISING EQUIPMENT

CROWN
CROWN RHEOSTAT and SUPPLY COMPANY
1965 PRATT BOULEVARD • ELK GROVE VILLAGE, ILLINOIS • (A SUBURB OF CHICAGO)

NOW THE FINEST ALUMINUM FINISHING

starts and ends with DIVERSEY

ZN 77 fast-acting Zincate Immersion Compound for improved electro-plating

Provides an unusually adherent zinc base on aluminum and aluminum alloys. Low concentration—Low drag-out loss. Fast acting, 30 to 120 seconds. Highly soluble, free-flowing, non-caking. Wide temperature range.

DIVERCOAT 2A meets MIL-C-5541 specification covering immersion coatings

Produces a protective chromate coating that resists corrosion, serves as paint base or decorative finish. Fast, easy-to-use. Only one to three ounces per gallon solution at room temperature required.

DIVERSEY NO. 202... light etching alkaline soak tank cleaner . . . activates metal for faster more uniform etch.

DIVERSEY ALUMINUX... original non-sludging, non-scaling alkaline etchant . . . provides finer, more uniform etch.

DIVERSEY NO. 514... for rapid, complete removal of smut. For use at room temperature.

For the products and know-how to meet all your aluminum finishing requirements, consult your Diversey D-Man. Or use handy coupon for specific details.

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CHICAGO ILLINOIS

The Diversey Corporation
1820 W. Roscoe Street
Chicago 13, Illinois

Please send complete information on products checked below.

☐ ZN 77 ☐ DIVERCOAT 2A

☐ DIVERSEY NO. 202 ☐ ALUMINUX ☐ DIVERSEY NO. 514

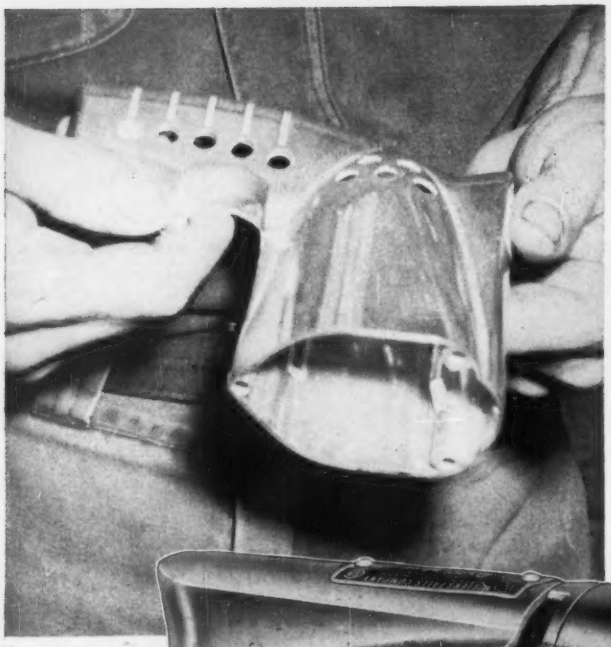
Company_____

Name_____

Title_____

Street_____

City_____ Zone____ State_____



Applying Selling Power to Millers Falls Drills

AHCO Burnishing Compound AL-2

It's good looking, and Hubbard-Hall Planned Service helped make it that way. Millers Falls production people knew that craftsmen like to be proud of their tools — proud of the way they work *and* proud of the way they look. So they talked to their Hubbard-Hall Representative about a bright, uniform, long-lasting finish for their power drills. Back from Hubbard-Hall chemists came Ahco Burnishing Compound AL-2, just the answer Millers Falls was looking for. When the price turned out to be right and the service excellent — we planned it that way — Millers Falls became a regular user of AL-2.

Next time *you* take a long look at your finishing operations — let us look, too. Then we'll submit a detailed recommendation. We'll show you how Hubbard-Hall Planned Service can add "Selling Power" to *your* products. In the meantime, let us send you our latest metal finishing bulletins.

PLANNED SERVICE *for better metal finishing*

THE Hubbard-Hall CHEMICAL COMPANY • Waterbury, Conn.

whatever your finishing problem

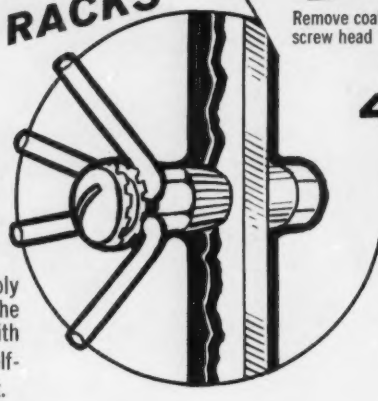
ACME has—or will design—a machine to solve it

Buffing automobile ventwindow frames with Acme machines sets a new production record for one manufacturer—300% more than the previous high! Faster than ever before, and automatically, Acme buffing machines remove "orange peel" and pits, and give the steel frames a flawless high-luster finish for plating. ■ This is the kind of efficiency that cost-conscious companies, large and small, expect from Acme finishing machines. Basic machine designs achieved over 50 years give Acme customers an advantage of selecting one of many equipment arrangements, even for specialized finishing applications. ■ Automotive trim, building hardware, electrical and plumbing fixtures, appliance bodies and trim, primary metal sheets and coils—it's impossible to list here all the mass-produced parts and products now served by Acme machines. Fact is, Acme has—or will build—custom machines to solve deburring, polishing, and buffing problems in all industries, including yours. Call or write for comprehensive catalog today.

ACME MANUFACTURING COMPANY

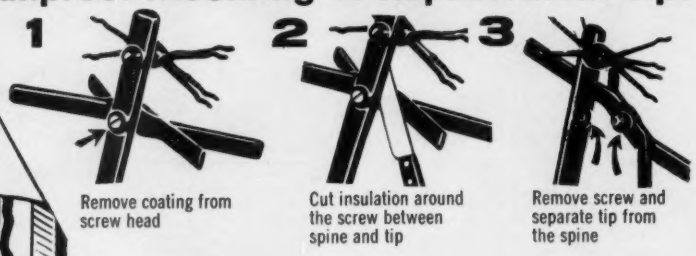
1400 E. 9 MILE ROAD, DETROIT 20 (FERNDALE), MICHIGAN / LEADING PRODUCERS OF AUTOMATIC POLISHING & BUFFING MACHINES SINCE 1910

New MASS-PRODUCED Convertible PLATING RACKS with Replaceable Bolt-On Tips

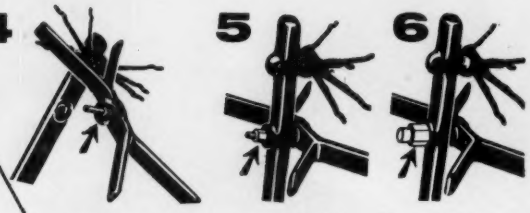


This **new** bolted tip assembly makes it easy to remove the original tips and replace with THINKER BOY pre-coated self-sealing tips as shown at right.

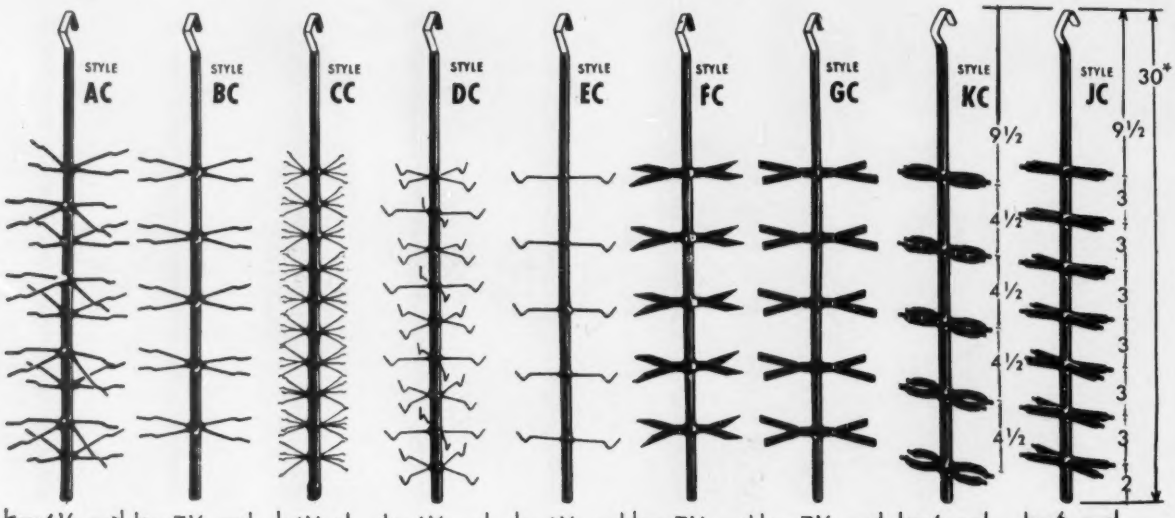
Leakproof Mounting of Replacement Tips



1. Remove coating from screw head
2. Cut insulation around the screw between spine and tip
3. Remove screw and separate tip from the spine



4. New tip with stud ready to install (Cut-away shows knurler)
5. Install tip and draw nut tight
6. Screw plastic cap onto the stud over the nut and draw tight



AC 6.95 BC 5.77 CC 7.35 DC 6.95 EC 5.20 FC 6.95 GC 6.95 KC 6.95 JC 7.85

Order by the letter designations.

*36" lengths also available.

On orders for less than 12 add $1.50 packing charges.

All prices F.O.B. Chicago subject to change without notice.

REMEMBER

These New Convertible Racks look like Economy Racks **but** the tips are replaceable with self-sealing THINKER BOY Tips.

Another difference—Convertible Rack Spines are 25% heavier than Economy Rack Spines.

100% Plating Capacity easily Maintained!

Now BELKE Quality, all copper, plastisol insulated plating racks *with replaceable* tips at only pennies more than the low—low prices of BELKE Economy Plating Racks.

Quick, on-the-job replacement of broken tips keeps these *New Convertible racks at full plating capacity through endless years of use.*

For high racking efficiency with reduced racking costs specify BELKE Convertible on your next rack order.

Belke MANUFACTURING COMPANY
947 N. Cicero Ave., Chicago 51, Ill.
EVERYTHING FOR PLATING PLANTS

New Wyandotte **BUFSOL**

REMOVES STUBBORN BUFFING COMPOUNDS WITHOUT SOLVENTS

Here's photographic proof!
LEFT: Buffed die-cast handle enters plating department with impacted buffing-compound deposits and handling smears.
RIGHT: Just 2 to 5 minutes in hot BUFSOL bath is all that's needed for results like this. Part takes a mirror-bright copper and nickel plate. Perfect adhesion—no stains—no streaks!

...adaptable to every plating cycle

New BUFSOL is fast, safe, effective . . . the perfect solution to your plating department's No. 1 headache—buffing-compound removal. Check these performance features:

Highly effective: BUFSOL assures bright, stain-free, adherent electrodeposits—removes most buffing compounds, tripoli, and rouges—rapidly removes water-dispersible-type compounds.

Concentrated: BUFSOL solutions have long life even when loaded with buffing compound. BUFSOL is completely miscible in water, is used as a dilute solution.

No plating bath contamination: BUFSOL, a liquid detergent concentrate, rinses easily from recesses and damaged rack coatings. Can't interfere with electrocleaner performance!

Safe on metals: BUFSOL will not etch, darken, or attack zinc-base die castings, copper, brass, steel, or aluminum when used at recommended concentrations and temperatures.

Essentially odorless: BUFSOL produces no obnoxious fumes or odors, requires no special ventilation.

For full information on new BUFSOL, and other Wyandotte metal-cleaning products, call in a skilled Wyandotte representative today! *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, California. Offices in principal cities.*

Wyandotte CHEMICALS

J. B. FORD DIVISION

THE BEST IN CHEMICAL PRODUCTS FOR METAL FINISHING

MANHATTAN RUBBER LINING PROTECTS COSTLY PICKLING AND PLATING EQUIPMENT ... *Permanently*

STOP CORROSION
STOP CONTAMINATION

- THICK, MULTIPLE CALENDERED SHEETS
- INSEPARABLE RUBBER-TO-METAL BOND
- ELIMINATE DANGEROUS "STRAY CURRENTS"
- NATURAL OR SYNTHETIC RUBBER
- WON'T HARDEN, CRACK OR OXIDIZE
- TESTED UNDER HIGH VOLTAGE

Be *certain* of lifetime protection for your costly equipment and protection against contamination of expensive plating baths. Specify Manhattan lining on your next tank lining job.

Photo courtesy Hanson-Van Winkle-Munning Co.

MANY MANHATTAN LINED TANKS HAVE BEEN IN CONTINUOUS USE OVER 30 YEARS!

ENGINEERED RUBBER PRODUCTS . . MORE USE PER DOLLAR

RM

Rubber Lining Plants at Passaic, N. J. • North Charleston, S. C. • Neenah, Wis.

RAYBESTOS - MANHATTAN, INC.

MANHATTAN RUBBER DIVISION • PASSAIC, NEW JERSEY

RM1039-R

Rhodium ELECTROPLATING SOLUTIONS

Backed by 59 Years of Specialization

Consult our staff, without obligation, about your specific plating problems.

Rhodium electroplate is suggested for these applications: on wave guides and microwave equipment which may be used in marine atmosphere; in printed circuits; in electrical contacts where light contact pressure and low voltages are involved... Rhodium is very hard and corrosion-resistant.

This Rhodium plating solution is easy to use. It operates over a wide range of temperature and current densities. We will be glad to plate samples without charge.

SINCE 1901

SIGMUND COHN MFG. CO., INC. — 121 SOUTH COLUMBUS AVE. MOUNT VERNON, N.Y.

Cycleflex

FULLY AUTOMATIC
PLATER & ANODIZER

Conveyor Breakdowns Eliminated with new electro-mechanical control and safety device. Racks can't be pushed into sides of tank; load can't drop if power fails during work transfers.

Positive 6-Point Connections. Self-cleaning heavy duty contacts need little or no attention.

Rack Carriers Quickly Removed. A big time saver when servicing, or manually plating large pieces.

Fast Cycle Changes by shifting tank partitions and moving pick-up heads.

No Extra Headroom Required. All elevating mechanism operates below top of rack carrier.

Automatic Loading And Unloading of racks.

Delayed Set-Down to operate automatically with cycle. Furnished if required for conversion coatings and bright dips.

If More Than One Cycle is necessary, by-passing can be built in.

Hydraulic operation, standard.
Pneumatic operation, optional.

MAIL COUPON TODAY

ONE MAN

handles complete operation of this

MOST VERSATILE

OF ALL AUTOMATICS

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ATTACH TO COMPANY LETTERHEAD

Send complete information on fully automatic Cycleflex

Name.....

Title.....

To 14 of the 21 leading companies making cars and automotive supplies, Unichrome Coating 218X on the plating racks is a good investment. This plastisol insulation is so tough that damage is a rarity—and long life the rule. It won't chip, crack, tear . . . is highly resistant to abrasion. Racks stay sleek, smooth, tightly sealed in severest plating operations—minimize contamination and drag-out problems.

Because of this extended service life and reduced maintenance, users' costs are minimum. All agree that the best quality saves money in the long run.

Why not follow the leaders' preference for Coating 218X. If you don't apply it yourself, nearby experienced specialists can do it for you. Contact us for details. METAL & THERMIT CORPORATION, General Offices, Rahway, New Jersey.

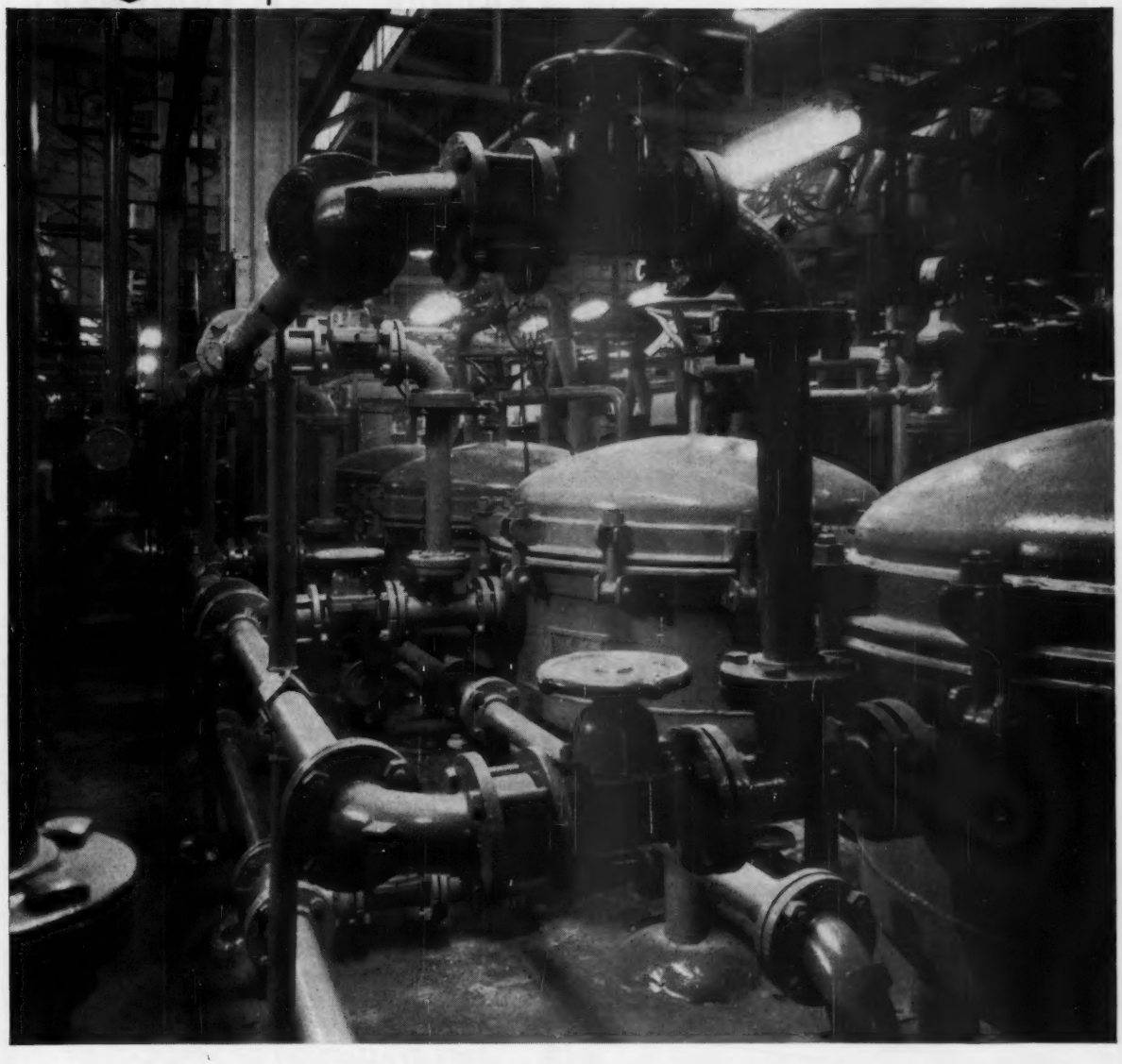
M&T **coatings and finishes**
METAL & THERMIT CORPORATION

2 OF EVERY 3 LEADERS IN THE AUTOMOTIVE INDUSTRY

...coat plating racks with Unichrome Coating 218X!

photo courtesy: Ford Motor Co.

DOW | **SARAN LINED PIPE**



After 80,000,000 gallons of hot acid . . .

not a failure in 5,000 feet of Saran Lined Pipe

7,500 gallons per hour of hot acid solution . . . nearly two years of continuous trouble-free service with little maintenance . . . and there's never been a failure or replacement in the 5,000 feet of Saran Lined Pipe.

The above installation is a portion of the exclusively used Saran Lined Pipe which serves the plating plant of a leading automotive hardware manufacturer. This piping carries highly reactive copper and nickel plating solutions to plating machines, then returns them for filtering before reuse. Solution temperatures range from 105° F. to 150° F. Saran Lined Pipe is also used to connect plating tanks to heat exchangers, and as supply and return lines to solution storage tanks.

Plant engineering personnel state that the advantages they find in Saran Lined Pipe are ". . . corrosion resistance to the chemicals, ability to withstand temperatures of 150° F., strong and rigid enough to be installed without need of additional support."

When plans call for piping systems that must resist corrosion and chemical activity, specify Saran Lined Pipe. Saran Lined Pipe, fittings, valves and pumps are available for systems operating from vacuum to 300 psi, and from below zero to 200° F. They can be cut, fitted and modified easily — right on the job. For more information write Saran Lined Pipe Company, 2415 Burdette Avenue, Ferndale, Michigan, Dept. 2501CF11.

See "The Dow Hour of Great Mysteries" on TV.

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Abrasive Flap Wheel for Grinding and Polishing

Schaffner manufacturing company, inc.

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SCHAFFNER CENTER
EMSWORTH, PITTSBURGH 2, PA.
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Metal Center Aircooled (bias type) Buff

Schaffner manufacturing company, inc.

SCHAFFNER CENTER
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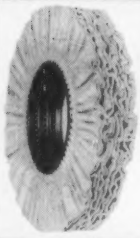
POplar 1-9902

Centerless (bias type) Buff



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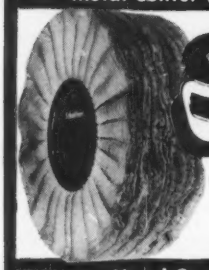
Metal Center (Bias Type) Cloth and Sisal Buff



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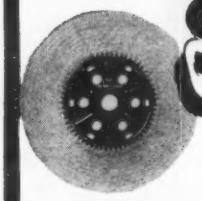
Metal Center (Bias Type) Sisal Buff



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Metal Center Abrasive Buff

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POplar 1-9902

Use

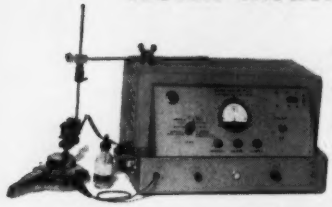
KOCOUR TEST EQUIPMENT

TO SOLVE YOUR

plating thickness problems!

You can depend on the

KOCOUR ELECTRONIC THICKNESS TESTER Model 955



- direct reading
- virtually automatic
- 90-95% accurate
- simple operation

WIDE APPLICATION RANGE!

Determines the thickness of brass, cadmium, decorative and heavy chromium, copper, lead, lead-tin, nickel, silver, tin, tin-zinc, and zinc deposits on various basis-metals. The thickness range is from 2-3 millionths up to 0.002". In addition, composite coatings can be tested. You get individual readings of the ACTUAL thickness of each deposit.
You can also test deposits on wire with Accessory Unit Model WT. (A.S.T.M. Spec. B-298-55T for testing silver coated copper wire.)

DEPENDABLE ACCURACY!

Accuracy is 90-95%. Human error is virtually eliminated. A positive "Calibration" feature monitors both accuracy and performance.

SIMPLE OPERATION!

Just set up the specimen and press a button. The average test takes about 1 minute . . . readings are direct.

15 DAY FREE TRIAL!

Try it in your own plant for 15 days. See for yourself how it works . . . what it does . . . how well it suits your application. Your satisfaction is guaranteed.

FREE EVALUATION OF APPLICATION

Just send us full details concerning your application including the plating/basis metal combinations and thickness range of each . . . or, just write for Bulletin 400. There's no charge . . . no obligation.

● KOCOUR testing sets are used all over the world for controlling plating — cleaning — pickling — anodizing — and hardening processes . . . special sets can be provided for your requirements.
Write today for complete information — no cost or obligation.

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CHICAGO 32, ILLINOIS

Specify KOCOUR test sets from your supplier.

SOLVAY® CHEMICALS

for { METAL FINISHING, CLEANING, PROTECTION

MUTUAL® CHROMIC ACID	**Uses:** Chromium plating. Anodizing of aluminum to resist corrosion. Pickling and bright dipping of copper, copper alloys, zinc, cadmium, aluminum, magnesium. Active ingredient in chromate conversion coatings. Packaged in Steel Drums.
MUTUAL SODIUM BICHROMATE	**Uses:** Pickling and bright dipping of copper, copper alloys, zinc, cadmium, aluminum, magnesium. Active ingredient in chromate conversion coatings. Packaged in Paper Bags, waterproof Burlap Bags, Fiber Drums, Steel Drums, Tank Cars, Tank Trucks.
MUTUAL POTASSIUM BICHROMATE	**Use:** Active ingredient in chromate conversion coatings. Packaged in Paper Bags, Fiber Drums, Steel Drums.
METHYLENE CHLORIDE	**Use:** A most effective paint stripper. In specialized solvent-type formulations, quickly and thoroughly removes caustic-resistant organic finishes from wood, aluminum, etc.
SOLVENTS	**Methylene Chloride** (Also see above). Non-flammable. Low in toxicity. Used to dilute flammable solvents to raise flash points into the safety zone. Used with an evaporation retardant for cold dip degreasing of metal parts. Packaged in Drums, Tank Cars. **Carbon Tetrachloride.** Solvent for metal degreasing. Non-flammable. Packaged in Tank Cars, non-returnable Rheemcote Lined Drums. **Chloroform.** Non-flammable solvent. Packaged in Tank Cars, non-returnable Drums. **Monochlorobenzene.** Solvent of moderately high flash point. Packaged in Steel Drums, Tank Cars, Tank Trucks. **Ortho-dichlorobenzene.** Solvent of moderately high flash point. Packaged in non-returnable Steel Drums, Tank Cars, Tank Trucks.
SODIUM NITRITE	**Uses:** Forms an invisible, water-soluble gamma oxide protective film that guards metal surfaces against corrosion. Used with nitrates for heat treating metal. Low melting point. Used with caustic soda for blackening steel. Oxidizing agent. Packaged in Barrels, Steel Drums, Bags, Tank Cars.
HYDROGEN PEROXIDE	**Uses:** Used as a depolarizer, to remove hydrogen gas from metal surface. Used in metal salt solutions to purify. Removes iron in nickel plating. Cleans, brightens metal surfaces. Oxidizing agent for phosphate coatings. Oxidizing agent for zinc phosphate baths. Removes iron. Packaged in returnable Aluminum Drums, Tank Cars, Tank Trucks.
METHYL CHLORIDE	**Use:** In metal annealing salt baths, assists in dissolving oxide impurities. Packaged in pressurized Tank Cars.

Allied Chemical

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SOLVAY branch offices and dealers are located in major centers from coast to coast.

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Please send me further information on_____
(list products and uses that interest you)

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Company_____

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It's Time to End the Confusion About Nickel Plating Processes

H-VW-M's New, Improved Levelume 220 is the Brightest Idea Among Today's Bright Nickel Baths

If you're confused, move over. So are a lot of other people in the plating business who are wading through the jungle of competitive claims.

H-VW-M takes the tiger by the tail in introducing Levelume 220—repeat Levelume 220—a bright nickel finish better than the original Levelume and ready to tackle any bright finish *production* job.

Levelume 220 is one of three new job-proved nickel baths offered by H-VW-M, each tailor-made to meet specific finishing requirements.

Let's consider the advantages and characteristics of each.

SUPERLUME

Superlume is the premium bright nickel, the ultimate in brightness building with leveling. Superlume is for those users who want tip-top performance to meet the finest possible finishing requirements and are willing to spend a little more for the very best. The cost difference often can be recaptured in total finishing costs.

LEVELUME 220

Levelume 220 is a modified Superlume and is the brightest, highest leveling nickel available *at no premium cost*. Levelume 220 features high brightness with uniformity of brightness on all surfaces, high tolerance to impurities, excellent leveling or scratch-hiding. Levelume 220 is truly the workhorse of all bright nickel plating processes, and meets the requirements of most high-quality bright nickel plating at moderate cost.

PERMALUME

Easy-to-operate Permalume is a sulfur-free, semi-bright leveling nickel process for dual nickel or duplex systems. It has been thoroughly production tested in commercial applications, with excellent results. The Permalume bath is stable and can be filtered continuously through a carbon pack to maintain constantly favorable plating characteristics. It does not require periodic stripping to remove degradation products. Permalume permits continuous operation . . . no downtime for bath purification and replacement of expensive addition agents removed by treatment.

Levelume 220 is an ideal top coating for duplex systems using H-VW-M's new semi-bright Permalume as a base coat. The Levelume 220-Permalume combination provides maximum corrosion resistance, compatibility, activity, leveling and stability. For duplex coating on diecastings and steel stampings, this combination of star performers is unbeatable.

Levelume 220 is the clear-cut answer to bright nickel plating *at no premium cost*. For information and technical help, call on H-VW-M.

Hanson-Van Winkle-Munning Company, Matawan, New Jersey.
Offices in Principal Cities.

Alert Supply Company is H-VW-M in the West.
Los Angeles • San Francisco

H-VW-M

Progress in metalfinishing through advanced processes • equipment

ANACONDA "PLUS-4"

phosphorized copper anodes

in a new form

CURVED ANODES

for plating cylinders faster and more uniformly

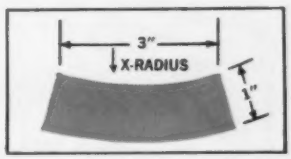
To make anode surfaces parallel the rotogravure cylinder being plated, and to fit the curve of the current-carrying slings, Anaconda "Plus-4" phosphorized copper anodes are now extruded to precisely curved shapes.

This design offers possible cost savings and improved cylinder quality.

It is reported that very uniform deposits are obtained from these specially shaped anodes, thus helping to cut finishing costs. The solution of the anode is also more uniform, thereby reducing the scrap.

For more information, write: Anaconda American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 60106

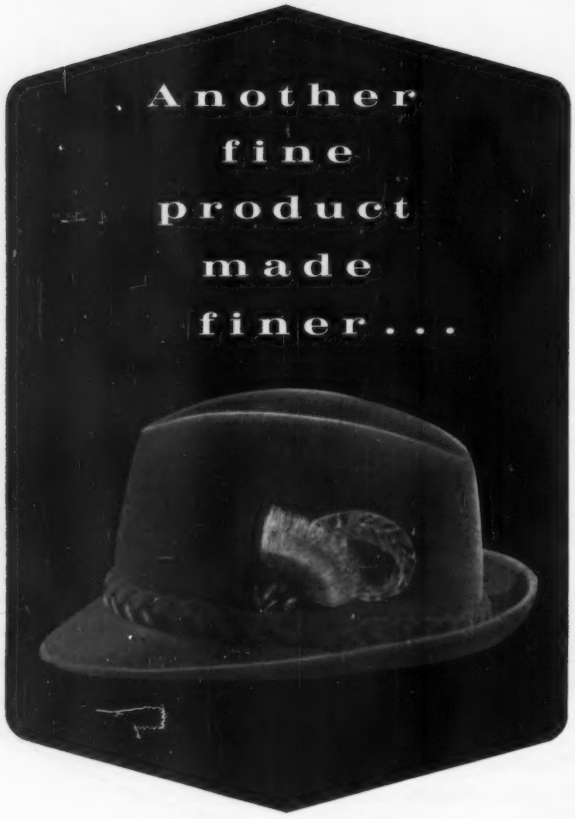
NO EXTRA DIE COST
Simply specify inside radius of anode.



"Plus-4"® phosphorized copper anodes

ANACONDA®

Anaconda American Brass Company



with the PARAMOUNT Finishing Touch

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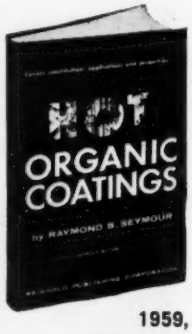

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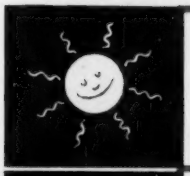

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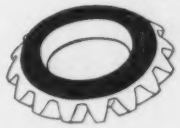

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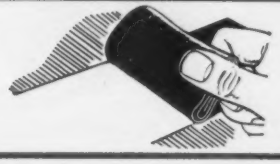

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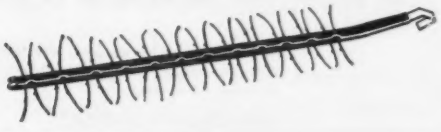

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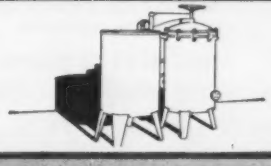

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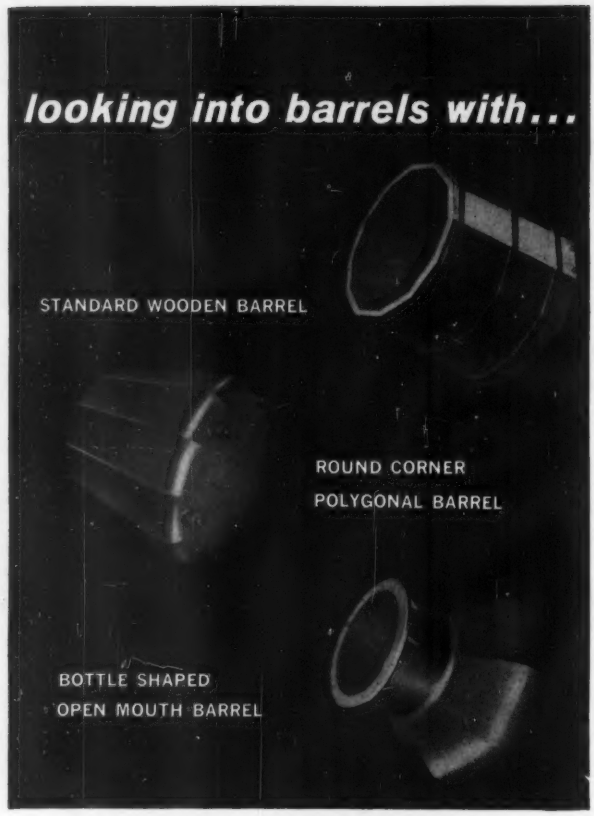

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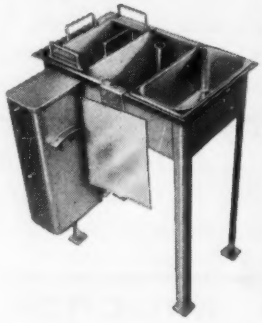

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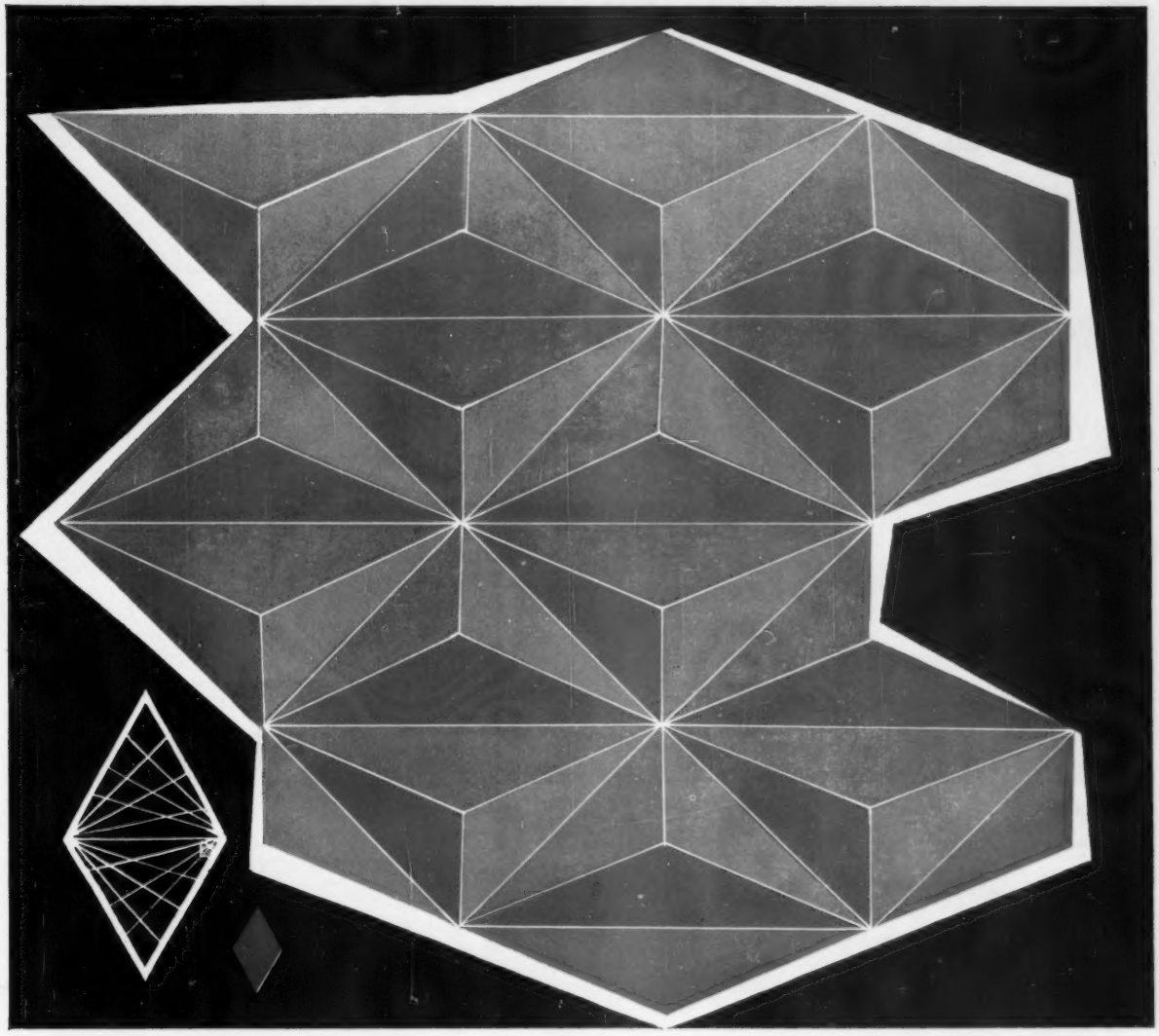

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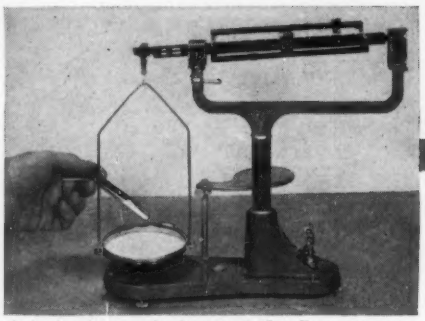
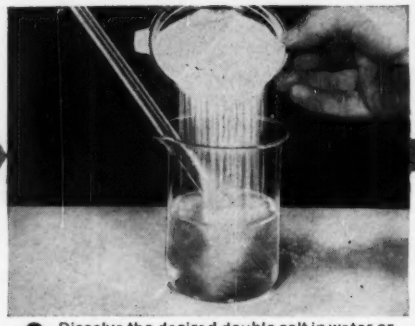


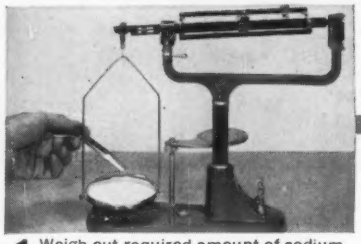
1 Just weigh required amount of sodium-copper or potassium-copper double salt.



2 Dissolve the desired double salt in water or plating solution.

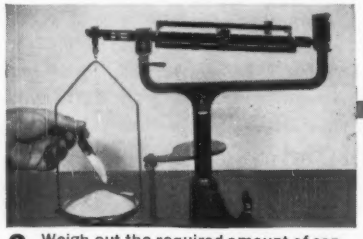
Laboratory demonstration shows how "direct-route" method saves time

Old "Indirect" Method

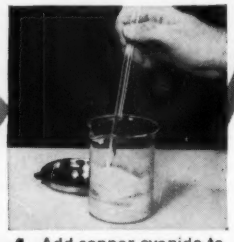


1 Weigh out required amount of sodium or potassium cyanide.

2 Dissolve the sodium or potassium cyanide in water.



3 Weigh out the required amount of copper cyanide.



4 Add copper cyanide to water and make a slurry.

5 Dissolve the copper cyanide slurry in solution of sodium or potassium cyanide.

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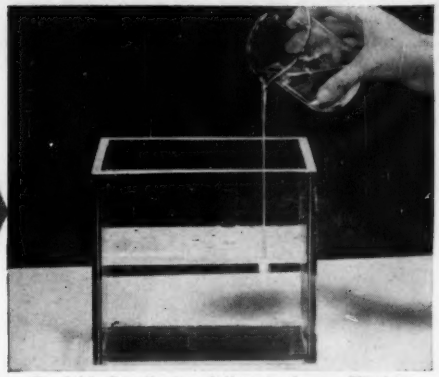

3 Add directly to plating tank—no filtering necessary.

...avoids errors.

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Sulfides (as sulfur)	10 ppm. max.	Less than 5 ppm.
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Sulfides (as sulfur)	10 ppm. max.	Less than 5 ppm.
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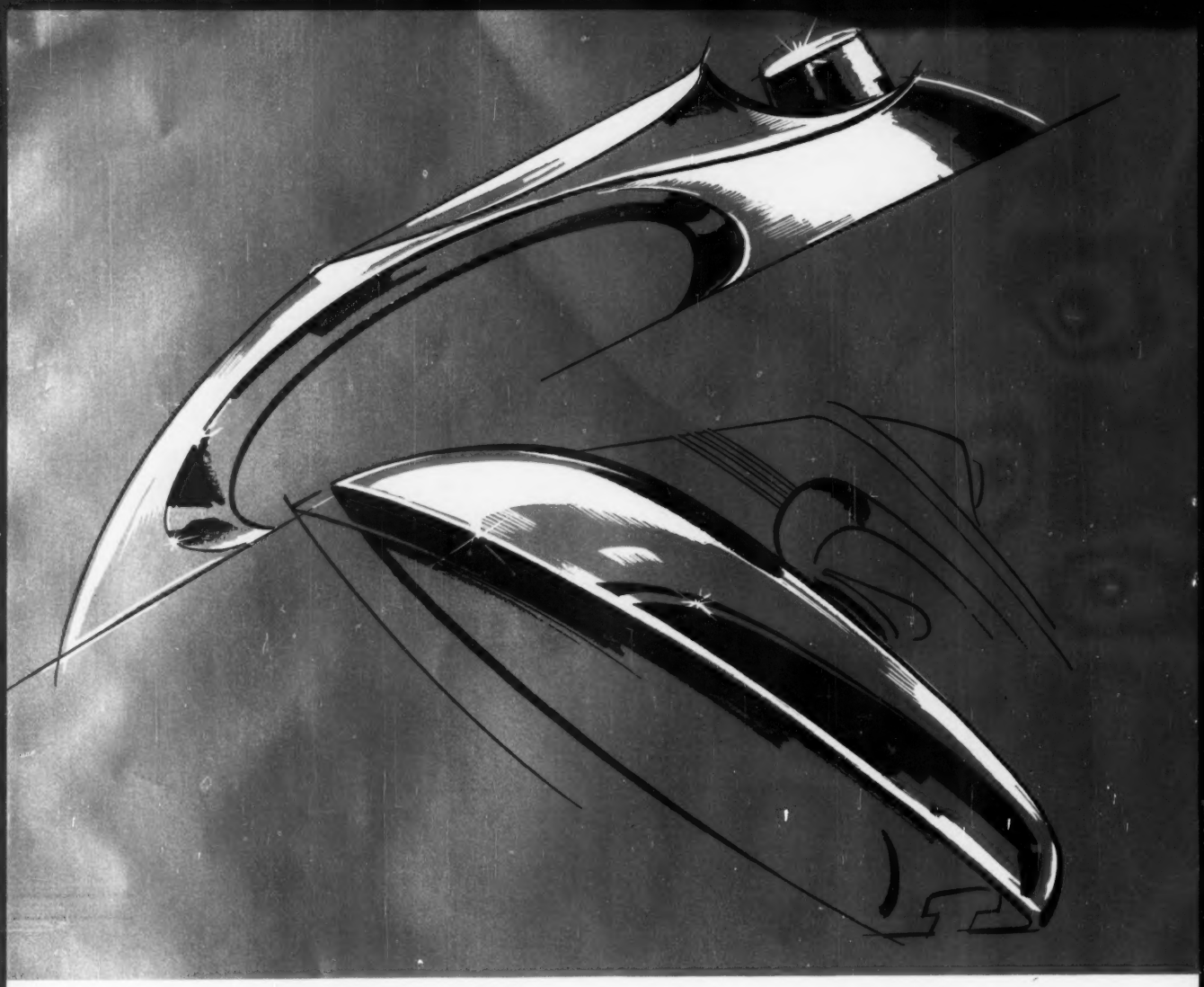

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ESTABLISHED 1903 VOLUME 58 • NUMBER 11 • NOVEMBER, 1960

CHROMIUM PLATING - THE NEW STATUS

While reading about some developments in chromium plating recently, it occurred to us that the important advances in this subject in the last few years have been overshadowed somewhat by the march of progress in general metal finishing techniques and equipment during the period.

The value of this fairly new knowledge can be especially appreciated by those who worked with the early baths thirty-odd years ago, when practically nothing was known about the deposit except that it was hard and tarnish-proof, and thank the Lord for chrome rouge! In the absence of effective analytical control of the bath, throwing power was a hit-and-miss proposition, and highly valued was the plater who was lucky enough to get coverage in even slight recesses without excessive edge burning. And, to top it all, the conception of what was satisfactory cleaning prior to nickel plating had to be altered completely when chromium was to be applied subsequently.

Recognition of the crack structure of chromium deposits and its effect on corrosion resistance of the underlying deposits was probably the first milestone. From this, also, evolved the principles of porous oil-holding chromium with its confirmed favorable effect on the life of moving parts in frictional contact. Once crack formation and its nature were appreciated, further research gave us two processes for deposition of thick layers of bright, crack-free chromium. Coincidentally with the discovery that a duplex deposit of sulfur-free nickel followed by bright nickel resulted in improved corrosion resistance, it was established that crack-free chromium, if followed by a chromium deposit with an extremely fine crack pattern, served to prevent localized corrosion at defects in the basis metal.

Investigators were not preoccupied with the deposit alone. The decrease in fatigue strength of steel resulting from chromium plating has been examined thoroughly, and the effect of baking and other treatments before and after plating, to restore the strength, established on a scientific basis. The search for control methods which would permit the plater to take advantage of the favorable characteristics of fluosilicate as a catalyst has led to baths in which the catalyst concentration is regulated automatically by the solubility of certain sulfate and fluosilicate salts. Solutions have been disclosed for production of black deposits and relatively soft, machineable ones. Spray depressants, although unsuitable for thick deposits due to their tendency to cause pitting, are available for decorative plating, where they minimize atmospheric contamination and loss of solution in the exhaust system.

With the wealth of information at hand, the chromium plater is no longer restricted by the limitations of the old process. Presented with the requirements, there is a strong probability that he will find available a method which will produce deposits of the required characteristics. Prometheus has been unbound!

Nathaniel Hall

Modern Polishing and Buffing

By Stanley P. Sax, *Executive Vice-President, American Buff Co., Chicago, Ill.*

This is the second and final installment of Mr. Sax's article on polishing and buffing. The first half appeared in the October issue.—*Ed.*

Unit or Spoke Cloth Buffs

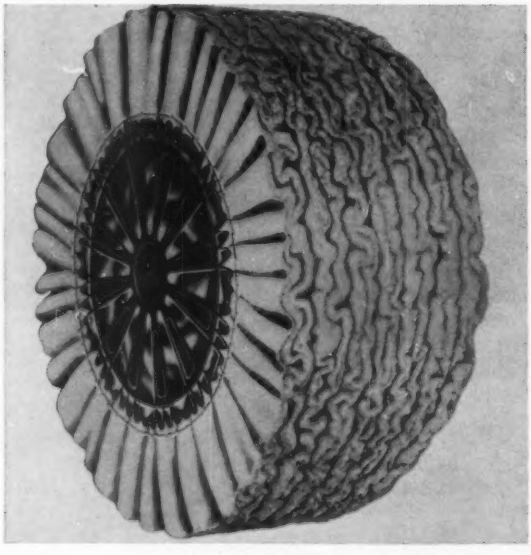
The unit cloth buff or spoke buff employs distinct design advantages. Puckered unit buffs run cooler than standard puckered buffs, have a knee-action, contour-following ability. Their pockets hold significantly greater amounts of compound. The clue to the development of this buff came from the oldtimers' practice of radially cutting conventional buff sections. Thus, the unit buff did the same thing, but did it better. The width of the units may easily be controlled. The density or hardness varies almost infinitely according to plies, stitching, materials, treatments, and center size. Some parts would be nearly impossible to buff without this specially developed tool. This design makes it possible to have a hard wearing buff that is also flexible. On automatics, it allows better part coverage with fewer heads and reduces cam requirements.

It is important in all buffs that the center holding device be designed properly, with sufficient strength to withstand the tremendous forces and pressures sometimes exerted in buffing. High speeds, large buff diameters, sudden shocks from an automatic conveyor slamming a part into a buff, may cause failures of clinching teeth, breakage of rings, and explosions of buff sections. Equipment has been damaged and men injured by these failures. The unit design is especially vulnerable to breakdowns, as each unit works independently and the individual unit may be called upon to undergo tremendous punishment. Some clinch ring designs perform consistently under these conditions without breakdown, whereas, others do not.

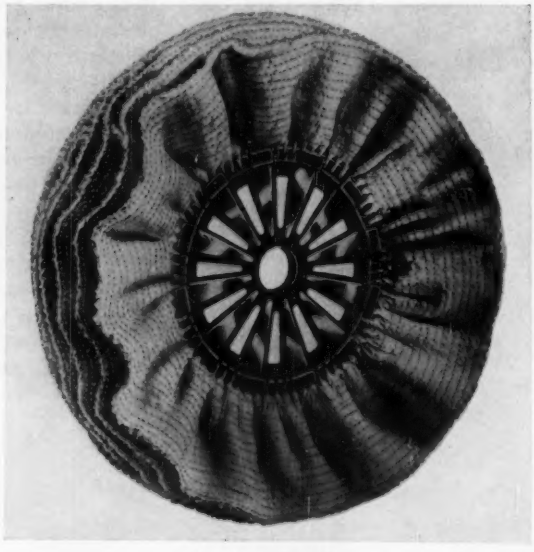
The advantage of separate units developed logically into the "flap" design. The flaps are placed at right angles to the direction of rotation of the wheel. Each one wipes up and cleans up after the other, which produces superior color. All flaps reinforce each other, resulting in greater wheel life. This is a very smooth running wheel, but proper pressures and speeds must be maintained to get optimum performance.

Flexible Abrasive Wheels

A recent development in finishing is the flexible abrasive wheel. It employs the concepts of grain and depth and polishing with a flexible medium. Flex-wheels have been used on all types of metals, rubber, wood, and plastics, and on all types of parts. Their



Pucker buff wheel.



Open puckered sisal.

BUFFING CALCULATOR

Quick, easy way to find proper Surface Speed, Spindle Speed, or Buff Diameter for practically any buffing job.

R.P.M. at Arbor or Spindle	DIAMETER OF BUFFING WHEEL IN INCHES										
	4	6	8	10	12	14	16	18	20	22	24
	SURFACE SPEED IN FEET PER MINUTE										
800	837	1256	1675	2094	2513	2932	3351	3770	4189	4608	5026
900	942	1413	1885	2356	2827	3298	3770	4241	4712	5184	5655
1000	1047	1570	2094	2618	3141	3665	4189	4712	5236	5760	6283
1100	1152	1727	2304	2880	3455	4031	4608	5183	5760	6336	6911
1200	1256	1884	2513	3142	3769	4398	5027	5655	6283	6912	7540
1300	1361	2042	2723	3404	4084	4764	5446	6126	6807	7488	8168
1400	1466	2199	2932	3666	4398	5131	5865	6597	7330	8064	8796
1500	1571	2356	3142	3927	4712	5497	6284	7069	7854	8640	9425
1600	1675	2513	3351	4189	5026	5864	6703	7540	8378	9216	10053
1700	1780	2670	3560	4451	5340	6230	7121	8011	8901	9792	10681
1800	1885	2827	3770	4713	5654	6597	7540	8482	9425	10368	11310
1900	1989	2984	3979	4975	5969	6963	7959	8954	9948	10944	11938
2000	2094	3141	4189	5236	6283	7330	8378	9425	10472	11520	12566
2100	2199	3298	4398	5498	6597	7696	8797	9896	10996	12096	13194
2200	2304	3455	4608	5760	6911	8063	9215	10367	11519	12672	13822
2300	2408	3612	4817	6022	7225	8429	9634	10839	12043	13248	14451
2400	2513	3770	5027	6284	7540	8796	10053	11310	12566	13824	15079
2500	2618	3927	5236	6545	7854	9162	10471	11781	13090	14400	15708
2600	2722	4084	5445	6807	8168	9529	10890	12253	13613	14976	16336
2700	2827	4241	5655	7069	8482	9895	11309	12724	14136	15552	16964
2800	2932	4398	5864	7331	8796	10262	11728	13196	14660	16128	17592
2900	3037	4555	6074	7592	9110	10629	12147	13667	15184	16704	18221
3000	3141	4712	6283	7854	9425	10996	12566	14137	15708	17280	18850

niche in the finishing world is somewhere between the heavy cut of belts and polishing wheels and the finer finish of sisal and cloth buffs. The finish a flex wheel produces is frequently the final finish required. If a more highly reflective surface is required, buffing may follow. Flex wheels eliminate the need for backstands required with belts and eliminate glueing and gritting of polishing wheels.

Sometimes the user must vary his practices for their use. Less pressure is usually called for. Trimming may be necessary. Treatment with greases and oils may moderate cut, result in longer wheel life and more uniform finish. Spacers and side supports may be needed.

Flex designs are available in four major types: straight-wind, pleated, unit, and flap.

They can be used to produce a satin finish, a straight line scratch pattern, a miscellaneous scratch pattern, or a semi-mirror finish. They can grain, smooth, blend welds, gates and draw marks, remove cold shut and surface defects, remove paint, rust, and corrosion, work complex surfaces without danger of gouging, and prepare for a painted or plated surface. The wheels rapidly conform to contours and, properly used with light pressures, do a tremendous amount of work.

Buffing Compounds

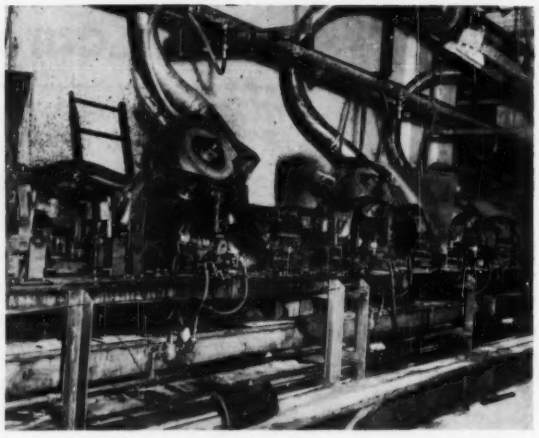
Generally speaking, buffing compounds may be applied in two basic ways. There is the solid bar type of compound, which is held against the buffing wheel to form a buffing head. The other method involves the use of compound in liquid form which is sprayed on the buffing wheel or on the work, applied with a brush, or dripped on the work from a melting pot. The melting pot method is used especially in nickel buffing, due to the difficulty of formulating a liquid lime. The binders used in compounds are primarily greases, fats, and waxes. Those in most general use are stearic acid, hydrogenated fatty acids, tallow, hydrogenated glycerides, and petrolatum. Companies engaged in producing compositions for buffing compounds recommend specific products for certain types of jobs. Greasier grades are generally used where the surface may be somewhat rough, for additional cutting action, and to reduce burning.

For softer metals, such as zinc, aluminum, brass, copper, as well as some of the plastics, tripoli compositions are used. This name is derived from a type of earth, gray, red, or yellow in color, which was originally found in Tripoli, North Africa. The American variety, commonly in use today, comes from Seneca, Mo.

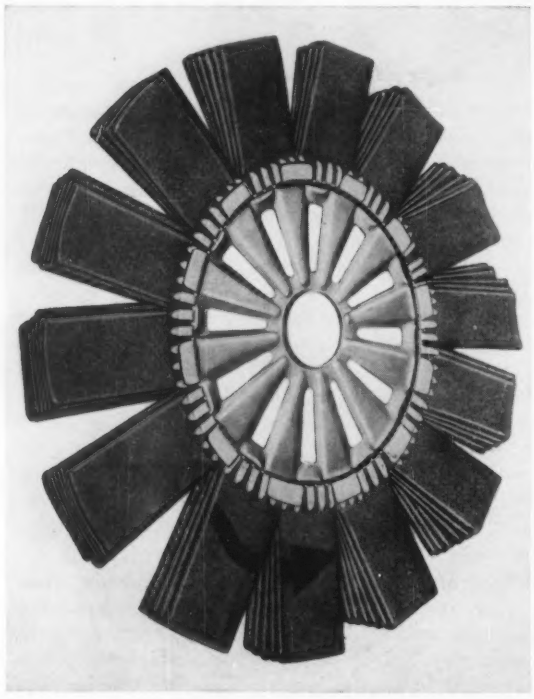
Compositions bearing the designation "steel," or "stainless steel," are recommended for the buffing and coloring of ferrous metals. Fused and unfused aluminum oxide powders are used as abrasives in its formulation. Greaseless compositions do the best job of producing a butler or satin finish. Greaseless compositions use glue as a bond instead of grease.

Liquid compositions often save in compound used. Room temperature fluid binders, such as oil solutions and water emulsions, take the place of greases, waxes, and fats that set up solid in room temperature. There are no leftover nubbins which require re-melting. Weardown caused by applying the compound to the buff surface is eliminated. The possibility of fire is reduced. Compound application by the spray method results in greater uniformity. Some liquid compounds do not retain the abrasive in proper suspension and, therefore, require frequent agitation. Proper formulation eliminates this problem.

Various grades and types of adhesives and binders are used on different metals to achieve different finishes. The formulator can vary the types and proportions almost infinitely to achieve the desired finish on a specific part. With knowledge, experience and persistence, almost any formulation can be improved. Additional abrasives, not previously mentioned, are white silica powders for nonferrous metals, coarser red iron oxide powder (crocus) on steel cutlery and nonferrous metals. Fine red iron oxide powder (rouge) is used for coloring silver and gold, fine soft white silica powders for coloring aluminum and brass, and fine chromium oxide powder for coloring stainless steel and chromium. The more frequent applications of smaller quantities made possible by spray application reduces the amount of compound used. Cleaning requirements after buffing are reduced or eliminated. Production often is increased since changing bars, with resultant down-time, is eliminated. The buff also is kept in proper cutting condition at all times. Increased production, increased buff life, decreased compound consumption, decreased fire hazard, more uniform finish, and better cleaning have resulted in a steady increase in the proportion of buffing done by the spray method.



Spray polishing operation on bumper parts.



Flexible unit abrasive polishing wheel.

Buffing Operations

Experience has indicated certain laws or rules that may be applied to the art of buffing. A part must be exposed to a buff surface for a sufficient length of time to achieve a desired finish. Experience determines the time required for different metal and different finishes. This may be measured in hundredths of a minute per linear inch. Therefore, the higher the surface speed of the buff, the shorter the time that will be required. Other things being equal, parts will be produced faster at higher shaft rpm's and large wheel diameters. There is an optimum surface speed for every metal and metal condition, depending also on the finish required. Contour of the work, fixtures, operator, and conveyor speeds sometimes prevent the attainment of this ideal surface speed.

Buffing machines usually are not equipped to vary rpm easily during buff weardown. Some hand machines have this facility, but full automatic machines seldom are so equipped. Even when they are, the operator may fail to use this costly added feature.

Surface speed is a function of diameter of the buff and rpm of the shaft. Naturally, as the buff diameter decreases, the surface speed decreases. Since shaft speed is seldom varied to compensate for this weardown, it is best to choose an average usable buff diameter in determining shaft rotating speed.

Varying rpm speeds, to adapt machinery to a new job, is an advisable procedure, assuring that the machine has sufficient power to maintain the rpm during periods of heavy pressure. The motor power must be sufficient to pull the load created by the buff against the part. The power requirement becomes greater with increased surface area and increased contour of part, increased width and weight of buff head, and increased speed of rotation of shaft. Buffing departments are re-

quired to finish metals of various types. Those metals vary in hardness and structure. Different metals require different buffs designed to achieve the ultimate in finish, production, and buff-life. Buff guides are available, based on the experience of users with all types of metals. They are designed to aid in the selection of the best buff.

Facing and Balance

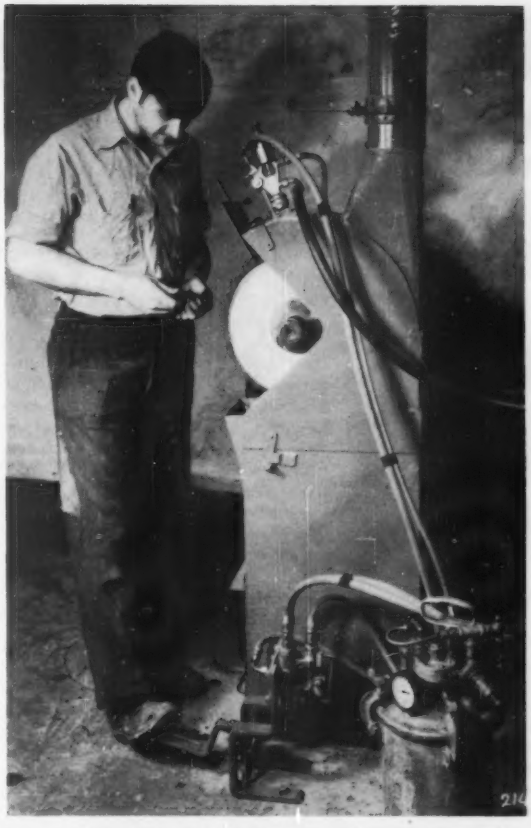
Buffs, properly faced, are ready to accept compound immediately. A properly broken-in buff will perform better during its entire buffing life. The user need perform no raking. Facing must not start microscopic rips in the fabric, or pull bias sewing threads out beyond the outside diameter of the buff.

A buff must be properly designed to start off in balance and stay in balance during its entire life. Some machines are delicately balanced, and unbalanced buffs will cause severe shaking. Wide wheels and long shafts are not very tolerant of unbalanced buffs. Unbalanced buffs can produce a balanced wheel, but only in the hands of a skilled operator, who rotates the sections, counterbalancing one unbalanced buff with another. A wheel made up of counterbalanced, out-of-balance sections will usually go out of balance again as it is used.

Out of balance buffs are caused by:

1. Off-center arbor holes
2. Out-of-round center plates
3. Irregular gathering or puckering
4. Overlap of cloth
5. Improper facing
6. Irregular centers
7. Uneven treatment

Uneven buff wear, shortened buff life, poor finish, sprung spindles and worn-out bearings, reduced production, and increased worker fatigue are results of unbalanced buffs. The following table shows the amount of centrifugal force exerted by an imbalance of an ounce or two.



Spray buffing. Automatic gun (air operated) on hand polishing lathe. Foot valve for operating gun and two gallon pressure feed tank. Gun may be mounted in any position.

Spray buffing operation on wheel covers.

Centrifugal Force on Buffs

diam.	*rpm*	*1 oz. force*	*2 oz. force*
12″	1800	34.5 lbs.	68 lbs.
12″	2600	72 ″	144 ″
14″	1800	40 ″	80 ″
14″	2600	84 ″	168 ″

Other Buffing Considerations

THREAD AND STITCHING:

Thread varies according to type, twist, whether glazed or unglazed, size strength, and treatment. Stitching varies according to number of stitches per inch, tension, and type: lock (locked at buff center) or chain. Lock stitching is usually stronger, whereas, chain stitching is less costly to apply. The thread used must be strong enough to do its job. The number of stitches per inch must be correct.

BUFF WIDTH:

Other things being equal, wider buffs should reduce buffing costs, as proportionate assembly cost, sewing cost, and center cost are reduced. Where the extra

(*Continued on page* 52)

Direct Nickel Plating Of Hardenable Stainless Steel

By Bruce E. Scott, *Curtiss-Wright Corp., Wright Aeronautical Div., Wood-Ridge, N. J.*

Bruce E. Scott is a native of New Jersey and received his education at Bergen College and New York University with an AB degree in Chemistry. He spent a year in the laboratories of Citro Chem. Co., Maywood, N. J. and then joined the Wright Aeronautical Division of Curtiss-Wright in 1939, where all his time has been spent in the Metallurgy Division of the Engineering Department. At various times he has been in charge of fuel and lubricant analysis, instrument and wet chemical analysis, corrosion research, radiography, and electroplating control and development. He was instrumental in the development of cadmium-tin alloy plating and the applications of electroless nickel to pistons. Immediately after World War II, he was chairman of an SAE committee on Preservatives and Humidity Cabinet Testing. He was the author of the paper "Alloy Plating for Aircraft Engines" presented at the Cincinnati Convention of the American Electroplaters' Society in 1958.

At the present time he is a staff project engineer assigned to special projects.

ELECTROPLATING engineering in modern industry is rapidly achieving the stature and recognition it so richly deserves. While decorative plating forms a large part of the product, the years since World War II have accelerated the use of electrodeposited metals for engineering purposes.

This has been particularly true of aircraft and their components. When we speak of aircraft quality in a product, we know it has to be the best, and it is in the selection and application of materials and processes for aircraft use that the electroplating engineer has made such great progess.

Not only must the proper coating be selected for its primary purpose, usually corrosion protection for the basis of metal, but other factors must be considered. Will the stresses in the coating reduce the fatigue strength of the part? This consideration is important in aircraft and engines as many parts must necessarily operate near their load limit. Is hydrogen embrittlement a factor and, if so, what relief technique is suitable? Many aircraft engine parts are carburized, which limits hydrogen embrittlement relief temperatures to 300°F. Is galvanic corrosion important when induced by mating parts, or by possible damage to the coating if it is cathodic to the basis metal? Will the coating still protect after exposure to high temperatures, as in jet engines?

These are some of the factors that must be considered in the solution of a specific problem. All of this work precedes pilot trials where the production troubles of fixturing, etc., are encountered.

The basic engineering of an aircraft engine must necessarily concern itself with strength of materials and design of components. Material selection must often be made for these reasons, with protection of the components from corrosion being secondary.

A Curtiss-Wright jet aircraft engine was developed and placed in production utilizing a semi-stainless steel for some of the compressor rotor blades. This material is essentially AISI Type 410 with a chromium level of about 12%. Operational experience with the engine, particularly in naval service, indicated that corrosion of these blades was sufficient to be of concern. As a temporary measure, the blades were coated with epoxy-phenolic resin, with the recognition that operational environments would soon cause the resin to wear off.

In the meantime, work was initiated on a permanent type coating which would give maximum protection during an overhaul period. Among the coatings considered was one that has been very versatile in the plating industry, namely, nickel. The available data on nickel were evaluated on a preliminary basis, and the results looked promising. Abrasion resistance was good, and a smooth, bright deposit could be obtained which would not detract from airflow characteristics of the blade.

Development of Adhesion Technique

The blade material being a semi-stainless, the first instinct was to use a Wood's nickel strike followed by a standard nickel deposit. Previous data on other alloys had indicated a 20% reduction in fatigue strength when using a Watts nickel. The data of Figure 1 showed a 13% reduction in fatigue strength

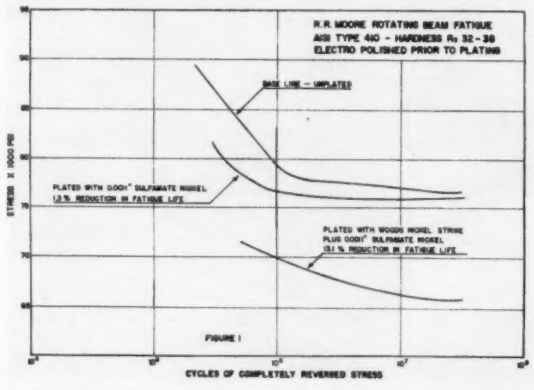

R.R. MOORE ROTATING BEAM FATIGUE
AISI TYPE 410 - HARDNESS Rc 32 - 36
ELECTRO POLISHED PRIOR TO PLATING
BASE LINE - UNPLATED
PLATED WITH 0.001" SULFAMATE NICKEL
12.5 % REDUCTION IN FATIGUE LIFE
PLATED WITH WOODS NICKEL STRIKE
PLUS 0.001" SULFAMATE NICKEL
13.1 % REDUCTION IN FATIGUE LIFE
STRESS X 1000 PSI
CYCLES OF COMPLETELY REVERSED STRESS
FIGURE 1

Fig. 1

PLATING PROCEDURE - SULFAMATE NICKEL DIRECTLY ON AISI TYPE 410

1. DEGREASE TO REMOVE OIL.
2. APPLY STOP-OFF TO UNPLATED AREAS.
3. VAPOR BLAST, IF DESIRED.
4. ASSEMBLE ON RACK.
5. ANODIC ALKALINE CLEAN. 1-2 MINUTES AT 6 VOLTS.
6. HOT AND COLD WATER RINSE.
7. IMMERSE IN C.P. HYDROCHLORIC ACID, CONCENTRATED AT ROOM TEMPERATURE FOR TWO (2) MINUTES, OR IN 50% C.P. HYDROCHLORIC ACID AT 120-130°F FOR TWO (2) MINUTES.
8. COLD WATER RINSE, 30 SECONDS, MAXIMUM.
9. IMMERSE IN NICKEL SULFAMATE ACTIVATOR (PH REDUCED TO 1 WITH SULFAMIC ACID) FOR TWO (2) MINUTES AT ROOM TEMPERATURE.
10. WITHOUT RINSING AND WITHIN 20 SECONDS, TRANSFER TO THE SULFAMATE NICKEL PLATING BATH. MAKE CURRENT CONTACT PRIOR TO ENTERING THE BATCH. STRIKE AT A MINIMUM CURRENT DENSITY OF 80 ASF FOR ONE (1) MINUTE OR UNTIL THE ITEM IS COMPLETELY COVERED WITH NICKEL.
11. PLATE AT 20 ASF FOR THE TIME NECESSARY TO PRODUCE THE DEPOSIT THICKNESS REQUIRED.
12. HOT AND COLD WATER RINSE.
13. DRY.
14. HEAT TREAT 1/2 HOUR AT 375°F.

Fig. 2

of the steel when Wood's nickel is used as a strike followed by a compressive sulfamate nickel deposit. This loss in fatigue strength immediately discarded the system, as no significant reduction in fatigue strength could be tolerated.

Since nickel appeared to be the most suitable coating and, since known data showed that no significant loss in fatigue strength would be encountered with a compressive sulfamate nickel, the attempt was made to deposit such a coating directly.

The technique developed produced a process on which steps have been taken to obtain patent protection. As will be recognized, the greatest problem arose in activation of the surface of the 12% chromium steel and in maintaining the activity of that surface. Standard techniques for such activation produced poor inconsistent results. Hydrochloric acid in various concentrations and at various temperatures resulted only in peeling deposits.

Since the sulfamate nickel bath is based on sulfamic acid, such an acid dip prior to insertion in the plating bath was tried using both room and elevated temperatures. Some measure of success was found, but the results were erratic. At this point it was found that acid activation temperatures of 130°F. or higher were not feasible, as the parts dried too quickly during transfer to the plating bath.

It was found that insertion of the parts in the plating tank with the current already on was mandatory. When the plating current was applied after the pieces were in the tank, adhesion was consistently poor. However, during the activation experiments described previously it was noted that, when the current was applied prior to insertion in the plating tank, some good adhesion was obtained.

At this time a long look was taken at the progress that had been made, and a new series of experiments was established. In this series, concentrated hydrochloric acid was used for primary activation along with a sulfamic acid bath, to produce a compatible acid film upon entry into the plating bath. This series also explored variations in current density on entry into the nickel bath. It was found that better adhesion than that experienced previously was obtained up to about 40 amp./ft.^{2} but then began to degrade above this value. Even at 40 amp./ft.^{2} the results were not consistently good.

It was postulated that the acid film in contact with the pieces was too low in metal content for the high current on insertion. Although the time element was short, the initial current impulse striking the parts to be plated was traveling through a film devoid of metal, producing only hydrogen beneath the metal layer that immediately followed. It was further postulated that, if the sulfamic acid etch bath were to contain nickel, the metal starvation in the transfer film would be corrected. In order to prove the theory, a regular sulfamate nickel bath was used in which the pH was lowered to 1 with sulfamic acid. Immediate success was obtained in that nearly all of the specimens showed good adhesion. When restrictions on transfer times were worked out, the process became 100% feasible.

The final process procedure developed is shown in Figure 2. After degreasing and masking, if necessary, the parts may be vapor blasted or not, as desired, though vapor blasting does appear to provide a cleaner basic surface. The anodic alkaline clean and rinse are standard operations. The primary activation bath can be either concentrated hydrochloric acid at room temperature or 50% HCl at about 120°F. What is of importance, however, is that the acid be the C.P. grade. Use of technical grade acid will produce poor adhesion. The two minute immersion is standard for either concentrated or dilute acid.

While good rinsing is recognized as an important step in all plating operations, the need here is particularly great. First, the time must be short; no more than 30 seconds can elapse from the hydrochloric acid bath to the sulfamate nickel activator bath, so that oxidation of the surface is held to a minimum. Second, the rinse must be thorough to minimize chloride contamination of the sulfamate plating bath. This is important, as chlorides will reduce the compressive stress in the deposit to the point where enough chloride is present to produce tensile stress.

The sulfamate nickel activator has been mentioned previously. The time again is two minutes at room temperature. Since the purpose of this bath is to produce a compatible film on the parts, no rinse is used and a direct transfer to the plating bath is made in what must be no more than 20 seconds to prevent oxidation. Contact with the plating current must be made at this time so that current is on when the parts enter the plating tank.

The minimum current density for entry into the plating tank is 80 amp./ft.^{2} for consistently good results. This is held for one minute or until the part is completely covered, and the plating rate is then dropped to 20 amp./ft.^{2} and the parts plated to established thickness requirements. The plating bath is a regular, chloride-free sulfamate nickel bath controlled to a minimum compressive stress of 7,500 psi.

In the plating of compressor blades, fixturing for proper deposit distribution was a serious problem.

The shape of the part tended to produce heavy deposits on leading and trailing edges when blueprint requirements were met in the center of the blade airfoil. The systems of fixturing were worked out by trial and error. In one system, the blade leading and trailing edges in a multiple part fixture mutually thieved each other, with control of the end blades by auxiliary thieves. This system did not produce consistent results so that the second system, employing plastic baffles which shield the leading and trailing edges, was adopted (Figure 3). This fixture provided satisfactory deposit distribution.

Testing the Finished Part

As was stated at the beginning, the program consisted of more than just a process development. When it was found that a consistent process for applying a compressive nickel deposit on semi-stainless steel had been achieved, the engineering phase was initiated. Specimens were prepared and plated for R. R. Moore Rotating Beam Fatigue Tests to determine if the deposit had any effect on fatigue strength of the

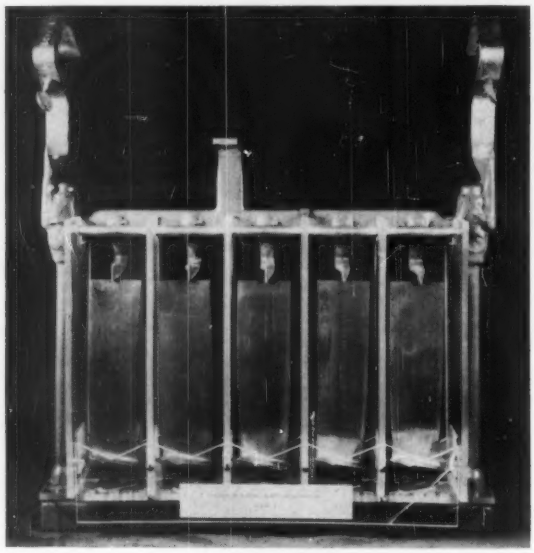


Fig. 3

basis material. The S-N curve shown in Figure 1, as noted previously, clearly shows that no significant lowering of fatigue strength of the basis metal was encountered. The 1.3% reduction reported is not significant, as the reproducibility of the test method is about $\pm 2\%$ for the stress level used.

The effects of hydrogen embrittlement from the plating cycle were studied by bend and static fatigue tests. All data were obtained in the "as plated" condition and after several relief heat treatments, all referred to unplated specimens for comparison (Figure 4). The angle to fracture of the basis metal was used in the simple bend test and indicated that hydrogen embrittlement was not a factor. These data were confirmed by the static fatigue test, where notched specimens are placed under static loading. Even though no embrittlement could be found, a relief heat treatment was incorporated in the procedure as insurance.

After leaping the first two hurdles of any possible

HYDROGEN EMBRITTLEMENT EVALUATION

	BARE	AS PLATED	PLATED PLUS 1/2 HR. AT 375°F	PLATED PLUS 4 HRS. AT 375°F
STATIC FATIGUE TEST 200 HR. RUNOUT ALL PLATING 0.005"	215,000 PSI	215,000 PSI	218,000 PSI	217,000 PSI
BEND TEST, ANGLE TO FRACTURE ALL PLATING 0.001"	60°-75°	65°-85°	80°	60°-80°

Fig. 4

effect of the deposit and/or the process on the material, the next step was to determine the effect on blades. The attempt was made to simulate, as closely as possible, the conditions encountered during engine operation that could lead to failure.

A compressor rotor blade is subjected to several types of force or stress in its normal operational environment, some of which can be evaluated only by using actual blades, due to the geometry of the part. Being a rotating part, radial centrifugal stresses are always present. Since these are essentially straight line functions operating in a single direction, no effect from the nickel deposit was expected or found, as indicated by the static fatigue test above. The vibratory stresses caused by air flow over the blade are more difficult to simulate on a test rig and, since they can lead to early fatigue failure, are important in blade evaluation.

The test rig used for vibratory stress evaluation is known as the "Bee Hive." The name is derived from the sound made by the blade as an air jet is passed over it, causing it to vibrate. The blades are vibrated at known stress levels and the number of cyclic stress reversals to failure are recorded, thus producing a regular S-N curve.

Base curves were prepared on bare, untreated blades for use as a reference. These tests were followed by nickel plated blades that had been prepared as outlined previously. The data obtained (Figure 5) showed that no significant reduction in fatigue life of the blades would result from the nickel deposit nor from the process used to deposit the nickel, as the slight reduction indicated is within normal test reproducibility.

The primary purpose of the nickel deposit on the blades was to protect the blades from corrosion. The most severe corrosion environment normally encountered is that of salt atmosphere in naval operations. Even though its limitations are recognized,

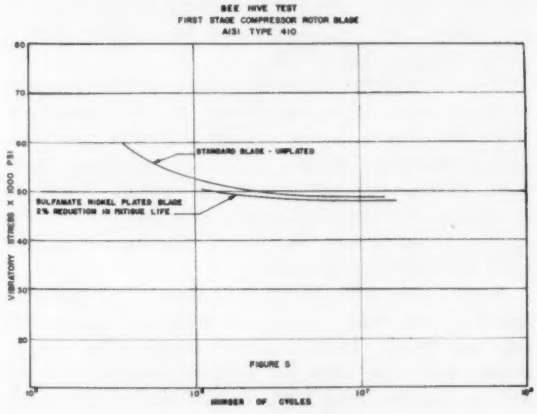
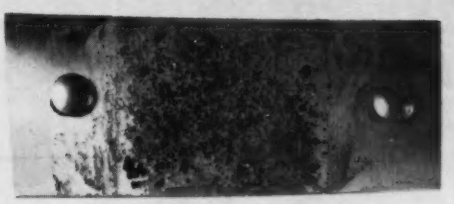


Fig. 5



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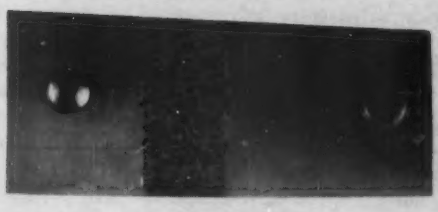
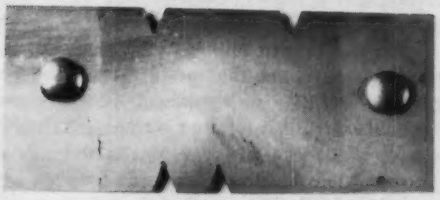


NICKEL-BASIS METAL INTERFACE

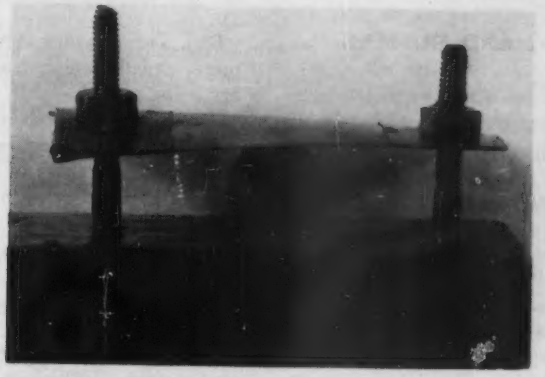


NICKEL PLUS NOTCHES IN EDGES

NICKEL PLUS NOTCHES, BRINELL BALL IMPRESSIONS, & ROCKWELL C IMPRESSIONS

NICKEL PLUS BRINELL BALL IMPRESSIONS

NICKEL PLUS ROCKWELL C IMPRESSIONS



TEST RIG FOR STRESSED SPECIMENS IN SALT SPRAY

SALT SPRAY TEST SPECIMENS
MODIFIED AISI TYPE 410 - 60,000 PSI STRESS

FIGURE 6

particularly in regard to correlation with operational conditions, the salt spray test was utilized for corrosion testing to be sure that the nickel deposit would provide satisfactory protection. The equipment and test procedure were in accordance with ASTM B117-49T. Since other tests to be described later were run for 5000 hours, the protection tests were also run for this period. Where the coating remained unbroken, the sulfamate nickel deposit provided excellent protection to the basis metal (Figure 6).

A normal operational hazard faced by a jet aircraft engine is minor foreign object damage in the compressor. This minor damage does not necessarily require overhaul of the engine, so that the aircraft can continue to fly. The reality of this type of damage raised another question. Would removal of the nickel deposit in local areas accelerate corrosion at the nickel-basis metal interface due to galvanic action, thereby leading to rapid failure of the blade?

The program to answer this question included measurements of the actual potential difference between nickel and the basis metal, which was found to be insignificant, and extensive salt spray exposure testing. Blades were plated to nominal nickel thickness of 0.001-0.0015″ and then test sections were cut from the blades. One group had an interface directly across the blade to represent major removal of the nickel, while the other groups had less severe damage by means of Brinell hardness ball impression, Rockwell C diamond impressions, and notches cut into leading and trailing edges as shown in Figure 6. Along with groups of bare blades similarly treated to serve as controls, the test pieces were clamped in test rigs at a stress of 60,000 psi. This stress value was chosen as 150% of normal operating stress levels. The test rigs were then placed in the salt spray cabinet.

Failure of a specimen was recorded when cracks appeared in the blade. The initial idea was to expose the specimens until a definite failure rate was established that would show whether or not galvanic action would accelerate failure. However, the final conclusion that was reached indicated no effect from galvanic action after 5000 hours in salt spray. This time under severe conditions indicated that plated blades would not be affected adversely by an interface of nickel and basis metal for the overhaul life of the blade of 600 hours of operation.

An attempt has been made here to show the scope of the engineering work necessary in the application of an electrodeposited coating in an aircraft engine. While a program of this nature does not apply to all engine parts, it is typical of the approach necessary when plating on highly stressed and critical parts. Development of the actual plating process is only a part of the whole picture and, while important, does not finalize the job at that point. When the plating process was found to be successful, it was visualized that it could be applied to other stainless steels without using a Wood's nickel strike. Unfortunately, time has not yet permitted the investigation to proceed beyond the modified AISI Type 410 that it was originally designed to cover. It is hoped that this extension can occur in the near future so that application of the plating process may be expanded.

Acknowledgement

The author wishes to acknowledge the major contributions to this project of *Leo Souzis*, assistant project engineer; *William Tillis*, chemical engineer; and *Jack Zulumian*, chemical technician. Without their ideas and techniques the project would not have been possible. The author also wishes to thank the *Curtiss-Wright Corp., Wright Aeronautical Div.* for permission to publish this information.

MODERN POLISHING AND BUFFING

(*Continued from page* 47)

width is due to additional material content, the only additional cost is that of the material itself. Increased material usually results in increased buff life, when the buff is properly designed and fitted to the job.

STREAKING:

Streaking is a problem frequently encountered in buffing, especially where the work has a non-cylindrical shape, and the buff is cut to conform to that shape. With this type of part, oscillating, or axial movement of the buff or part to avoid streaking is not always practical. Puckering and tapering are buff designs which eliminate streaking.

Present Research

The following mechanical variables are being studied: buff speed, linear speed of the test piece, and frequency of buff oscillation. Buff variables to be studied include: cloth type, thread count, cloth weight, twist, cut fiber length, design, density, and size of the buffing wheel. The pressure between the wheel and the work piece, and the amount and kind of buffing compound are being varied.

Observations are being made on: temperature of workpiece, power required by the motor, rate of cut, reflectivity, hardness of the workpiece, and the presence of hard particles in the test specimen.

Other variables which might be studied are center design, buff treatment variations, balance conditions, use of spacers, types of metals, shapes of parts, square inches of area of part buffed, number of pieces in fixture, hand or automatic application of compound, bar versus liquid type compound, weight of compound per shot, length of break-in period, facing of cloth, fray and lint condition, direction of rotation of buff, direction of travel of the workpiece, and angle of buff to the part. Many research pitfalls are possible due, partly, to the many variables under actual working conditions.

It is hoped that continuing research will be conducted. The buffing industry, in order to compete, must continue to outperform other methods of producing a bright, smooth surface. To do this economically, one must use the most modern tools and supplies available.

Science for the Coatings Technologist

Part XVI. Dispersion Continued: Individual Mills.

By E. S. Beck

Ball and Pebble Mills

HAVING discussed a number of the preliminary factors, we are now in a position to consider the individual dispersing processes and techniques. These are best taken up, perhaps, under the heading of the individual machines used for producing the dispersions.

At the present stage of the technology, it can be said with a good measure of accuracy that the closed mills, both ball mills and pebble mills account for the larger share of paint production. After these, it is not so easy to rate the mills in order of consequence. Perhaps highspeed stone mills or roller mills (of all types) represent the next most important group. After these come what can only be called specialty type machines: Baker-Perkins kneaders, sand grinders, attritors, single-roll mills, Banbury mixers, high-speed impellers, and, doubtless, other machines with which the author is unfamiliar, and hence cannot discuss.

From the point of view of scientific knowledge, the closed mills are far ahead of all the others. Almost all of the studies of milling have been based on these; and almost all of the scientific work on dispersion has been done with closed mills. As a result, we possess a tremendous body of technical knowledge about ball and pebble mills and a very skimpy technology for all the other processes.

Fortunately, the closed mills are the ones which are capable of widest application to the greatest number of pigments and vehicles. They are also the most economical of all mills to operate and can produce the largest amount of finished paint per unit of time. The sand mills may be able to challenge this latter feature of ball milling in a limited number of special cases (as will be considered later) but for all-around large-scale rapid out-put of all types of paints, the closed mills are the ones of choice.

Because of this tremendous utility and because of the impressive accumulation of technical data on these mills, our presentation of milling processes will be heavily weighted in favor of the closed mills.

Linings and Grinding Media

Paint closed mills are modifications of the long-used dry or wet grinding mills used in other industries. The two principal types are the lined and the unlined mills. In the unlined mills, the metal of the construction of the mill serves as the inside of the grinding chamber. This metal is usually steel, suitably case-hardened against excessive wear. It can also be stainless steel. The latter metal is much less apt to discolor or stain batches.

Lined mills are usually lined with ceramic blocks of one sort or another. These blocks are carefully fitted in the mill so that there is a minimum of space between each block. This reduces the accumulation of pigment in crevices, and makes the mill easier to clean between batches. The blocks are held in place by means of a suitable cement.

The interior of lined mills must be continually kept under inspection and observation. The presence of chipped blocks, worn areas, sharp or deep crevices indicates the need for repair or relining. If the lining is not kept in good condition, contamination of one batch by another by carry over pigment will occur. This can be avoided by scrupulous cleaning after each batch where a color change is planned. But this type of cleaning is extremely difficult with a mill in bad condition. The author has seen pebble mills where as many as ten individual washings with fresh solvent did not suffice to remove important amounts of carry-over pigment.

Linings are porcelain and other ceramics, such as high-gravity porcelain, buhr-stone, etc. Flint blocks are occasionally used, but their irregularity of shape requires an excess of cement. Linings are quite expensive, and extreme care to prevent excessive wear of linings is an effort well-spent. The chief if not the only purpose of ceramic linings is to eliminate iron contamination of batches, mainly to avoid discoloration. The amount of metal which is worn away in an ordinary operation in a closed mill is quite sufficient to discolor whites and other light-colored paints. Yellows become browns, blues grays, and clean colors dirty. This effect is magnified by the use of steel balls in a steel mill. There are other ill-effects from the presence of iron contamination, but these are relatively minor.

The grinding media are the balls or pebbles used within the mill as the means of producing the dispersion. These vary within a relatively narrow range of size. For best results, pebbles or porcelain balls should run in size from $\frac{5}{8}$ inch to no more than $1\frac{1}{4}$ or $1\frac{1}{2}$ inches in diameter. Porcelain balls are made in sizes up to 3 inches, but such large balls are very inefficient in paint grinding. In general, the smaller the size ball or pebble which is used, the better the results will be.

Some of the newer grinding media of the porcelain type which are being offered for use in paints are non-spherical. Shapes of high density porcelain are made in cylinders and in ovals. For each, theoretical reasons can be advanced to show why superior dispersion results will be obtained. If the ordinary flint or porcelain ball is considered as a perfect sphere, it can be seen that the point of contact with another sphere will be at only a single point. Two cylinders can be in contact through a goodly part or even all of their length. Since part of the dispersing action is the result of shear exerted on the charge by sliding contacts between the

individual grinding media, it can be seen that increased contacts should result in more effective dispersion.

While porcelain is still widely used for linings, it is less often used for the grinding media. Flint pebbles, generally imported from Belgium or France, were once very popular, and are still in wide-spread use. The flint pebbles are not a high-gravity medium, which is a disadvantage, as they fall slower through the grinding paste, and exert less force on impact. They are not very spherical, however, which is something of an advantage, as flat or irregular surfaces provide a greater area of contact between balls. This also makes the ball somewhat more difficult to clean. There is some tendency to become more spherical with use, but this is relatively minor. The amount of wear using flint pebbles is much less than with porcelain.

Another advantage of flint pebbles is that they run small. The larger the number of pebbles in a given volume, the greater the number of contacts between balls, hence the better the dispersing power.

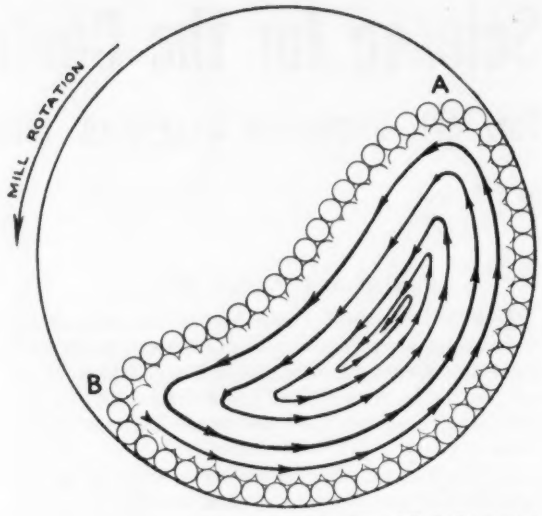
Flint pebbles are slightly porous. Other grinding media, even of the high-gravity types also tend to be somewhat porous and absorbent. Flint may be a little more than porcelain in this respect. This makes the pebbles difficult to clean. This objection is minimized in a factory equipped with large batteries of ball and pebble mills. A mill can be set aside for each color commonly ground. In this way, the problem of cleaning up for a color change is practically eliminated.

Ordinary porcelain balls are less popular than they once were. This is because they wear away so rapidly in the mill that their continual replacement becomes expensive. The material worn off acts as an extender in the paint being produced. If circumstances are such that excessive wear takes place with a material, very noticeable flattening of the finished paint can occur. Proper formulation of the grinding paste, particularly with reference to viscosity, can do a lot to keep pebble wear down to reasonable amounts. Also the amount of charge is important in this connection. But even under the best of conditions, wear of ordinary porcelain balls will run high.

High-gravity porcelain is superior in this and other respects. Because it is harder, there is less porosity of the surface. Because it is heavier, its value as a grinding medium is greater than that of regular porcelain (although still inferior to that of steel balls). The cost of high-gravity porcelain balls is higher than that of ordinary porcelain, but the reduced wear factor makes up the difference.

Steel balls are the grinding media par excellence when the presence of iron contamination is permissible in the paint. The very high specific gravity of the metal makes it possible to use small balls. The range in common use is quite narrow, running from about ½ inch to about ¾ inch. Steel balls are made from a variety of materials, all the way from plain steel, through case-hardened, through manganese-hardened to stainless steel.

The case-hardened or alloyed steel balls are preferable since they show less wear, giving less contamination of the batch. Case-hardened balls tend to wear rather rapidly once the case-hardening has been



(Courtesy of U. S. Stoneware)

Fig. 1. Grinding Action within Mill under Cascading Conditions. The diagram illustrates cascading action of the balls through the charge. The angle of break is about 50 degrees. Cascading is a very desirable condition for good dispersion. If the mill rotates too fast the balls will not cascade. If the viscosity of the paste is too high, little or no cascading will occur.

worn through. This can be overcome by using a type of ball which has been hardened all the way through. Each improvement in the ball increases the cost, so it becomes a matter of cost engineering to select the best value for a given set of circumstances.

The dispersing efficiency of steel balls is much greater than that of porcelain balls. As a rough rule of thumb, it can be assumed that under optimum conditions it will take from three to five times as long to achieve the same dispersion with pebbles as it does with steel. The higher gravity porcelain balls are faster than the low, but when compared with steel balls, they are still very slow.

The subject of the specific gravity of various grinding media has been mentioned a number of times. Porcelain runs from 2.2 to 2.4 in specific gravity. High-gravity porcelain runs from 3.0 to 3.6. Flint runs from 2.4 to 26, being therefore slightly heavier than ordinary porcelain.

The high-density porcelain is generally an alumina-based product, as against china clay used in regular porcelain. Zircon (zirconium silicate) is occasionally used as an ingredient in high-gravity porcelain. In addition to its higher specific gravity, high-density porcelain generally runs much harder than ordinary porcelain. A popular proprietary material runs 9.0 in Mohs hardness, for example. Regular porcelain runs 7.0 on the same scale. (diamond is 10 and talc is 1.)

Steel, of course, is much higher in specific gravity, running from 7.8 to 8.0. It is this very high specific gravity which confers the unusually good grinding properties on steel balls as grinding media.

The greater density of steel and high-density porcelain as compared with ordinary porcelain and flint produces faster dispersion because of faster fall of the balls through the paste and greater force of im-

pact on collision. The wearing and impact action of steel balls can be rather awesome: the writer has seen a drum bung-wrench accidentally ground in a steel ball mill batch for 48 hours. The heavy end of the steel device was ground down to the shape and the sharpness of a stiletto.

Perhaps it will be possible some day to combine the advantages of porcelain (good color) with those of steel (very high density). If a large steel core were to be coated with a heavy porcelain film, non-cracking and adherent in nature, the ideal grinding machine would be produced. The rate of wear of the porcelain would have to be very low or the practicality of the balls would be poor. As soon as the underlying steel was exposed, the value of the grinding medium would be gone, as far as good color is concerned.

Some laboratories and production people have worked out other arrangements to obtain the best properties of both steel and porcelain in one operation. It is known, for instance, that some manufacturers have succeeded in making whites in steel balls. Careful attention to the conditions of operation has shown that some formulations can be made with no significant discoloration provided the ratio of balls to paste, the viscosity, and the total load ratio of the mill are carefully controlled at optimum conditions. This is a tricky operation, and should be attempted only after careful study and preparation.

The use of flint pebbles within a steel mill or of steel balls within a porcelain-lined mill has also received consideration. No doubt some manufacturers have succeeded in working out such practices. In the case of flint pebbles within a steel mill, there is no large degree of contamination, with normal attention to operating conditions. But there is usually no improvement in grinding speed, either.

Steel balls used in a porcelain-lined mill can give fast dispersion without excessive contamination. But the danger of wearing out or cutting through the lining is very great. The utmost attention to obtaining and maintaining the ideal operating conditions is essential here. The practice is not wide-spread or recommended by the makers of mills.

Mill Construction

Closed mills are cylindrical in shape. Depending on the dimensions and other considerations, they are of various ratios of diameter to width. Each mill is constructed to give the optimum performance for its capacity.

Some steel ball mills are made with lifter bars or other devices to promote cascading of the balls within the mills. The bars prevent the balls from turning back as the mill rotates, so that a larger body of balls is available for falling forward with the motion of the mill. This gives an improved grinding action. It is not essential, however, for the grinding action of steel ball mills (when properly used) is quite good enough for most purposes without modification.

Loading and unloading are performed through an entry port bolted down when the mill is in use. Heavy pastes may give some difficulty during the unloading process. Mills are usually emptied by simple gravity flow but, in special circumstances, heating coils (to reduce viscosity) or compressed air can be provided to facilitate emptying the mill. However, unless there is an adequate wash for the mill, losses will run high for pastes of excessive viscosity.

Steel ball mills are generally built more ruggedly and with more powerful motors and accessory equipment than are pebble mills. This is because of the much greater weight of grinding media in the case of the steel balls. This is another reason why the use of steel balls in pebble mills should be approached very cautiously. The extra load may burn out the motor or the drive of the mill.

The speed of the mill may be considered at this point. Depending on its size, each mill runs at its own appropriate speed. Generally, the larger the mill, the lower its rate of rotation. This is because the pebbles or balls are moving faster at a given rpm as the diameter of the mill is increased. Roughly the same peripheral speed of the balls is wanted.

Most manufacturers adjust mills to operate at 50-60 percent of the critical speed. The critical speed is the rpm needed so that the grinding media are just held against the wall of the mill by centrifugal action. It is obvious that this rate of speed would be too fast for there would be no motion of the balls to produce the cascading and shearing action.

Temperature Controls

Most closed mills have a tendency to run hot. In the case of porcelain mills, the heat pick-up is frequently not excessive, if other operating conditions are controlled. Consequently, many porcelain mills are operated without temperature controls.

Temperature control is more desirable with steel ball mills because of the higher temperatures developed during operation. While many such mills are still used without any means of controlling temperatures, such devices are more common on steel ball mills than on pebble mills.

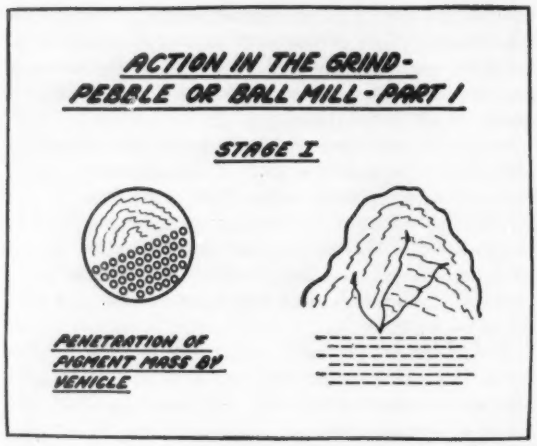
The simplest arrangement is one where water is splashed or poured over the outside of the mill. This can be rather messy, although rather effective. The more scientific way to cool the mill is by means of jacketing, and circulating water through the jacket.

Some very precise controls have been made whereby the temperature of the jacketing fluid is held to a certain temperature, such as 150°F. Users of such controlled equipment claim improved uniformity of grinding.

As the temperature does rise within the closed mills, the vapor pressure of the liquids used in the paste rises also. If very volatile or low-boiling solvents are used, the pressure within the mill can become very high. The writer has not heard of any mills bursting under the conditions, but covers have blown off as they were being unbolted and the contents of the mills have been sprayed over workers. It is good policy to avoid extremely volatile solvents, such as acetone or petroleum ether in closed mill grinding.

Charging

A great deal of study has gone into the proper charging of pebble and ball mills. We are now in the position of being able to make some very definite state-



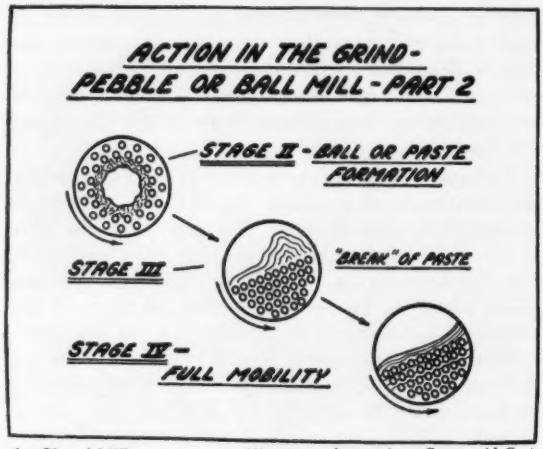

ACTION IN THE GRIND-
PEBBLE OR BALL MILL - PART 2
STAGE II - BALL OR PASTE FORMATION
STAGE III
"BREAK" OF PASTE
STAGE IV -
FULL MOBILITY

Fig. 2. Action Within the Closed Mill. *(Courtesy of American Cyanamid Co.)*

Ball mill grinds generally pass through these four stages if they are prepared at sufficiently high viscosity. A considerable amount of aggregation or clumping occurs in the first stages of ball mill grinding. Best technique is when conditions are such that the paste enters the stage of full mobility in no more than 12 hours of running time.

ments on the subject. The first statement is that the worst thing one can do is to fill the mill to the brim.

This is one of the commonest errors, and one which has yet to completely disappear from the paint industry. It is only natural to assume that if a 1000 gallon mill gives a good grind when loaded with 500 gals. of paste, it can also do so when circumstances call for 600 gallons of paste. Yet it may very well be that the grind cannot be obtained at all when the load is increased to 600 gal. Even if the desired dispersion is produced, it may take many times longer than when the mill was charged with 500 gal.

Many experiments by many operators have shown that the proper quantity of balls or other grinding media is approximately 50% of the total mill capacity. Thus, a 1000 gallon mill should be charged with 500 gallons of balls (apparent volume). There are a few exceptions to this rule. Many users of steel balls prefer to charge 40% instead of 50%. While this works well, 50% charging works equally well and gives a larger put-through of paste from the mill. The old-time practice of loading a ball mill only one-third full of steel balls is definitely wasteful of mill capacity.

The load of balls or pebbles contains, of course, an appreciable amount of open space, or voids. Regardless of the diameter of the balls, the void space remains roughly 40% of the apparent space. Thus, to continue our example, if the 1000 gallon mill were charged with 500 gallons of stones, the true volume would be 300 gallons of stones and 200 gallons of void space. It may be worthwhile to repeat that these figures hold true regardless of the size of the balls or the material out of which they are made.

O'Neill and Fremgen[2] thoroughly studied many variables in the pebble-milling of a specific group of formulas. On the subject of loading of pebbles, they found that 37% of true pebble volume, corresponding to 62% of apparent volume gave maximum out-put. While this is perhaps sufficiently close to the 50% figure given above to be acceptable, it must also be pointed out that the three values experimentally evaluated were 33%, 62% and 84%. Of these, 62% was outstandingly the best. It is also the closest to 50% of the three conditions studied.

Having established the optimum amount of balls to use in the mill, we will now look at the amount of actual paste which can be ground. It is an old rule of thumb that there should be enough paste in the mill to cover the stones with a little over. This rule was based on the desire to protect the mill rather than to obtain the best dispersing conditions. Experience has shown this amount to be indeed practical. We can therefore assume as a minimum amount of paste to be ground the amount equal to 100% of the void spaces of the balls. In our 1000 gallon mill example, this would give us the minimum of 200 gallons. This is probably a safe lower figure.

Some writers such as Pearce[3] prefer 25% of total mill capacity as a minimum loading. Lesser amounts, according to Pearce, will cause undue mill wear. In our case, this works out to 250 gallons minimum in our 1000 gallon mill.

O'Neill and Fremgen[2] in some of their examples, use as little as 66% of the voids of the balls. In our example this would be only 132 gallons. This is undoubtedly too low for proper mill protection, and should not be used steadily or continuously. Where actual particle size reduction is needed, such underloading may be required in order to obtain the dispersion in a reasonable time.

For the upper end of our range, we can take 45-50 per cent of the total capacity of the mill as the limit of practicability for most cases. This means that in our 1000 gallon mill we can grind a maximum of 450-500 gallon of paste. Experience in many practical runs has shown this to be a dependable figure.

Thus, in a 1000 gallon mill we can make from 200 to 500 gallons of paste. The temptation to put more into the mill is always present in production departments, it seems. But going even a little higher can result in extremely slow grinding.

In general, the lower the charge (provided the pebbles or balls are held at a constant level near 50%) the faster the grind will be produced. However, as the load is reduced, even though grinding time is reduced also, the output per batch is reduced and the time necessary for two loadings and unloadings must also be present. It is probably best to use the largest pos-

sible loading which will produce the required dispersion in some reasonable time. It is faster, in terms of actual paste through the mill, to grind a 45% load (450 gallons) for 48 hours to a given degree of dispersion than it is to prepare 200 gallons in 24 hours.

Such details are best worked out by actual practice on specific formulations. Some production men by careful attention to every condition and variable have reduced certain standard grinds to mill times of 4 to 8 hours. This is, however, very exceptional, and should not be taken for a normal or even optimum goal.

In fact, the tendency has been too much in the direction of shortened milling times. These exceptionally short grinds can give the specific degree of dispersion required, as shown by a dispersion gauge. But sometimes this is not enough. It seems that a certain amount of work must be done on the dispersion to obtain the best gloss, suspension, color development, etc. Often, stopping at the indicated dispersion (by measurement of particle size) is a mistake, and the grind should be continued further to obtain the best results.

This, again, is something which must be worked out for individual cases.

Paste Composition

The composition of the paste is another extremely important variable in the preparation of closed mill grinds. There are three major components of the paste: pigment, vehicle and solvent. Wetting and dispersing agents may be present. As a general rule the pigment content is set as high as operating and using conditions will permit. This is for two reasons.

First, of course, the output of finished paint is increased as the pigment content of the paste is increased. The whole object of the dispersion is to prepare the pigment in suitable form for use in the paint.

Second, as the pigment content of the paste is increased, the amount of pigment-to-pigment rubbing is increased during the dispersion process, hence an improvement in the speed of dispersion.

Daniel[4] in his classical paper on flow points recommends the general use of a vehicle at 20% solids for closed milling. Only in a few cases will it be necessary to go to a lower or a higher vehicle solids. Higher vehicle solids will be indicated where the grind seeds are being reduced. It will be also needed where the paint is high in pigment and short on solvent.

Daniel describes a method of determining the optimum pigment-vehicle ratio for closed mill grinding under the term *Flow Point*. By this method, a fixed weight of pigment is placed in a beaker, and measured amounts of vehicle run in from a burette. The mixture is rubbed with a rounded glass stirring rod until a specific, easily-recognized state of fluidity is obtained. This is termed the "flow point" and is the optimum grinding consistency and composition.

Generally, the flow point will be at the correct viscosity for milling. Daniel states that, for high-pigment grinds, pebble mill pastes work best at 70-80 K.U. (Kreb Units) viscosity and at 80-90 K.U. for steel ball mills. Most pigment mixtures at their flow points show a viscosity of about 80 K.U., making them suitable for use with little or no adjustment for both ball and pebble mill grinding.

Daniel originally ran flow points on each pigment at a number of different vehicle solids, selecting the most efficient for the actual grinding ratio. His work, however, showed that for most pigments 20% vehicle solids worked quite well, and this shortcut is recommended.

Each pigment will have its own individual flow point with each specific vehicle and solvent combination. As values are determined, they should be recorded for future use as well. The flow points seem to be completely additive, which is most convenient. That is, a mixture of pigments (if to be ground in the same vehicle as was used in determining the individual flow points) will require the predicted amount of vehicle obtained by calculating the need of each individual pigment. The convenience of this lies in the fact that, after enough determiantions have been made and determined, grinds of mixtures can be calculated on paper without need of preliminary laboratory determinations.

The compositions of the pastes arrived at by the use of the flow point method are surprisingly high in pigment. Whites using titanium dioxide can be made with a pigment content as high as 80%. A paste made at this extremely high concentration of pigment will require almost immediate addition of further vehicle once the dispersion has been obtained. This will reduce the tendency to shock when the dispersion is further reduced, and may also help to reduce settling.

As Daniel points out[4] it has been customary among many users of steel ball mills to require a high paste viscosity, usually increasing the viscosity with the size of the mill. In some cases, viscosities as high as 140 K.U. are called for. The usual explanation of this is that the high operating temperatures within the mill reduce the viscosity of the paste, hence increasing wear on the mill. The high paste viscosities are therefore to insure minimal mill wear.

However, in actual tests, it was shown that grinds prepared by the flow point method, despite their lower viscosities, showed less discoloration in steel ball mills than did more conventional high viscosity pastes. This would indicate that wear at the lower viscosities was actually less with well-formulated pastes. It is assumed that the discoloration is a good measure of the amount of metal worn off the balls and the side of the mill. As Daniel adds, this reduced wear may be owing partly to the reduced grinding time and partly to the increased importance of pigment shearing in this type of dispersion.

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2. O'Neill and Fremgen, Study of the Optimum Conditions for Pebble Mill Dispersions in Pliolite S-5 Systems. Official Digest, October, 1953.
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(To be concluded)

Finishing Operation Puts Waste to Work

By Richard L. Lang,
Eastern District Industrial Sales Manager,
The Ohio Fuel Gas Co., A Subsidiary of Columbia Gas

THE use of normally exhausted paint volatiles as an additional source of heat in baking ovens is cutting costs and reducing exhaust problems at the Gnadenhutten, Ohio plant of Alsco, Inc., world's largest producer of aluminum building products for home and commercial use.

In the process of finishing up to 20 miles of aluminum strip in 24 hours, from 10 to 20 gallons of paint vapor are produced every hour. Hydrocarbons are removed from this waste by catalysts and are passed through a gas flame. The heat produced by burning the paint volatiles is recirculated to the paint baking ovens. This improvement in finishing efficiency was developed jointly by engineers of Alsco and the Ohio Fuel Gas Company.

Surface coatings on Alsco aluminum siding must be able to withstand outdoor exposure for a minimum of 20 years. These surfaces are cured in gas-fired hot-air ovens operating at temperatures of 475° to 575°F., depending on the chemical composition of the material. Baking time in the oven is less than a minute.

The company formerly used steam to heat certain process lines. To improve the speed and efficiency of the finishing lines, a new two-strip line was added with immersion burners fueled by natural gas. Now the Gnadenhutten plant operates entirely on gas. Expansion of production has led to a twelve-fold increase in the plant's overall gas requirements.

Prior to painting, the aluminum coils are sized and passed through one of the two eight-tank conversion-coating lines. This process etches the metal and applies a conversion coating, providing an anchor for the final acrylic finish. The various colors are applied to the strips on one of four roll-coat painting lines. The painted coils are then formed, cut to length, and backed with foam to improve the insulation and noise-reduction characteristics of the siding.

A pioneer in the development of aluminum siding, Alsco, Inc. today has plants in Canada and Italy as well as in the U. S. The building trade has become one of the biggest buyers of aluminum and will use an estimated 700,000 tons this year. Efficient, high-quality finishing, in the light of this growth, becomes an increasingly important competitive factor in the aluminum industry.

Refinements in the finishing process, such as Alsco's use of waste paint volatiles with the aid of natural gas, will have a significant bearing on the future growth of the aluminum siding market.

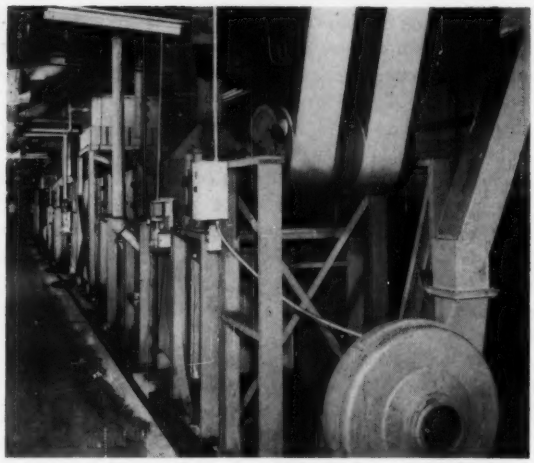


Fig. 1. Etching and conversion-coating line at Gnadenhutten, Ohio aluminum siding plant of Alsco, Inc., provides aluminum coil with anchor for acrylic finish. Eight-tank gas-fired line also removes rolling oils from aluminum strip.

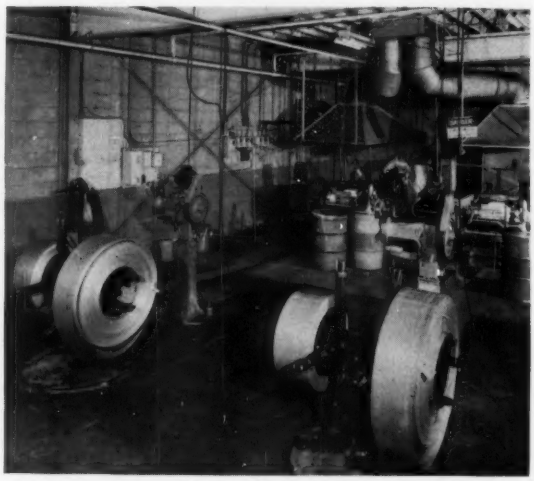


Fig. 2. Conversion-coated coil unwinds through a tension device to the coating head where paint from drums is applied. Aluminum strip then passes under hoods and into baking ovens. Ovens are heated by natural gas, and by combustible waste paint volatiles.

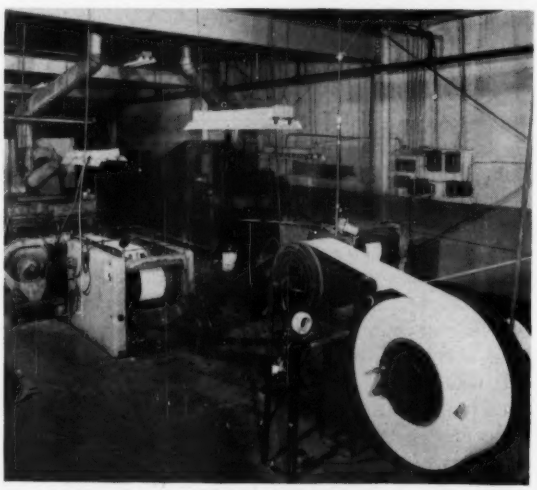


Fig. 3. At oven exit, painted aluminum is cooled by fans and water spray, then passes through tension device to be wound on drum. Acrylic-finished coil is now ready for final production stages.

The Chromic Acid Anodizing Bath and Its Control

By Herbert A. Prelinger, *Staff Engineer, Chemical-Metallurgical Lab., Adel Precision Products, Burbank, Calif.*

THE electrolytic oxidation process for coating aluminum alloys by means of chromic acid has been used extensively by the aircraft industry for a great many years. The mechanism of forming the oxide coat on the basis metal, its structure, and its properties, such as corrosion, wear, and electrical resistance, are known and well covered in the technical literature. The subject of bath control with respect to film quality, however, has been neglected somewhat. It is the purpose of this paper to report methods of bath control in relation to film quality.

When aluminum is made the anode in a bath of chromic acid or any other suitable electrolyte, and a current is passed through, a film of aluminum oxide is formed which is integrally bonded to the basis metal. The film, while being formed, is not completely insoluble. Roughly speaking, approximately half of the oxidized aluminum is retained as anodic film, the remainder goes into solution, forming alumina-chromic acid compounds. This combined chromic acid is lost for further electrolytic oxidation, and represents a measure of the rate of deterioration of the oxidizing bath. By the simultaneous formation and dissolution of the film, minute pores are created, through which a continuous current flows to the metal, forming new layers of aluminum oxide upon the metal surface. The coating, therefore, grows from the outside to the inside, and this will continue until the electrical resistance has increased to the extent of balancing the rate of film growth with that of film dissolution.

The quality of the oxide film, its corrosion and abrasion resistance depends on the chemistry of the chromic acid bath, and on the operating conditions, such as surface condition of the work, current density, bath temperature, and duration of the electrolytic treatment. The operating conditions are well understood and easily controlled and, therefore, do not require further discussion. The subject of bath composition, however, deserves attention, and shall be discussed in more detail.

Chemical Control of the Anodizing Bath

The chromic acid anodizing bath is maintained, in general, at 5-10% total chromic acid (6.7-13.4 oz./gal.), and operated at pH 0.2-0.85.

The method for controlling the chromic acid solution, as given in the literature, consists of the determination of the pH of the bath with a glass electrode, and its density with a Baumé hydrometer. From this data, and with the help of a chart, the amount of the total chromic acid is found, i.e. the amount of free and combined chromic acid plus the trivalent chromium that may be present. As will be seen, however, this method of bath control does not give a numerical evaluation of the free chromic acid, the constituent of the bath which is responsible for producing the corrosion-resistant film.

At this point it appears well to mention that the military specification covering the anodic coating of aluminum and its alloys (MIL-A-8625A) specifies the *quality* of the anodic coat only. According to this, film quality is evaluated either by determining the weight of the coating, or by subjecting it to specified conditions of salt spray (corrosion resistance). These two methods, as well as the corresponding results, cannot substitute one for another in regard to coating evaluation. An anodized surface, for instance, may pass the coating-weight test amply yet may fail when subjected to the 240-hour salt spray test. Such a case is illustrated in Fig. 1. This test panel failed after approximately 160 hours of salt spray exposure, as shown by the streaks of white corrosion products, while the analogue test panel anodized simultaneously with the disqualified one met the requirements of the coating-weight method most amply. The coating weight was 380 milligrams per sq. ft., as against the minimum requirement of 200 milligrams. Now, one may ask why the panel passed the coating-weight test, but failed the salt spray test? And, what was the chemistry of the anodizing bath? There is one answer to both questions: The bath had a sufficient amount of free

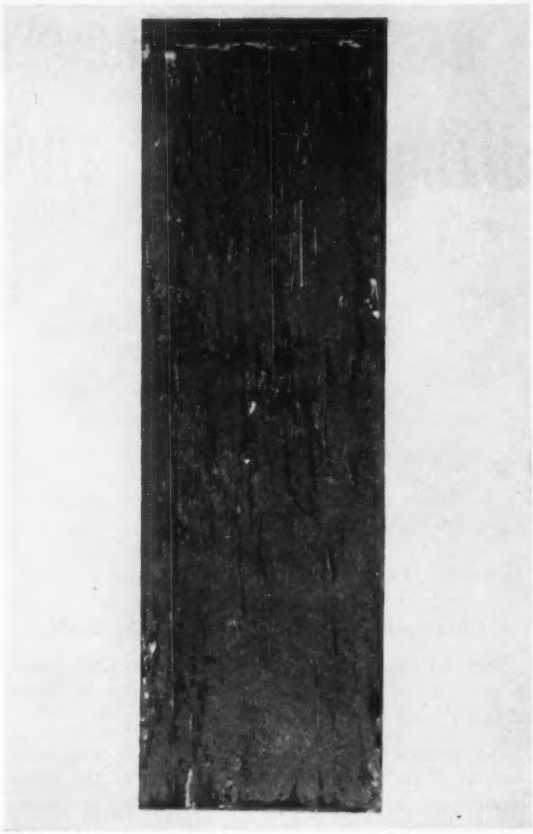


Fig. 1. Effect of 160 hour salt spray on anodized test panel. Note severe corrosion, although duplicate test panel passed the "coat-weight" method of film evaluation amply.

chromic acid to produce a coating of sufficient thickness and weight, but insufficient free acid to produce a film dense enough to withstand the 240-hour salt spray test, though bath was found to be within the permissible operating range of 10.2 oz./gal. total chromic acid, at a pH of 0.6. By comparing these two methods and their test results, the following statements appear justified:

(1) The two methods differ widely in film interpretation and evaluation, and their application, therefore, is not optional.

(2) The pH-Baumé method commonly used for bath control appears to be unsatisfactory when the production of a salt spray-resistant film is the objective.

(3) The direct determination of the amount of free chromic acid appears most essential for bath control.

Now the question arises as to the lowest amount of free chromic acid that will produce a film still dense enough to pass the 240-hour salt spray test.

No such data are known to exist in the technical literature, and there is also no minimum amount of *free* chromic acid specified in specification MIL-A-8625A. Nor, is there a requirement in this specification for the determination of the free chromic acid in the anodizing bath. The only basic requirement which a contractor must meet in order to qualify is that he provide facilities for quality control of the anodic film, either by salt spray resistance or by the optional coating-weight method.

Experimental

In order to throw some light on the subject, i.e. to find the minimum amount of free chromic acid that is required in a chromic acid bath to produce a salt spray-resistant film, a study was made on a commercial scale. For this purpose, a new 800 gallon bath was set up, using approximately 500 lbs. of chromic acid, dissolved in tap water. Analyzed, it contained 10.6 oz. of chromic acid (7.9%). The bath was analyzed frequently for total and free chromic acid, and for pH, according to production activity. Test panels for salt spray evaluation also were frequently prepared and such test executed.

The total chromic acid was determined by adding standard ferrous ammonium sulphate solution containing free sulphuric acid, and back titrating the unoxidized excess with N/10 potassium permanganate. The free chromic acid was determined by electrometric titration with a normal sodium hydroxide solution to a definite pH, as will be described in more detail in the following section. The pH values were determined with a glass electrode pH meter. The experimental results are shown in Table I:

TABLE I

Time, days	*Total CrO_3, oz./gal.*	*Free CrO_3, oz./gal.*	*pH*	*Quality of Anodized Film*
Start	10.6	10.4	0.2	
8	10.6	10.4	0.2	
28	10.6	8.6	0.25	Salt spray test passed
35	10.6	8.2	0.35	
47	10.0	7.6	0.5	
62	10.0	6.6	0.5	Salt spray test passed
77	9.1	5.2	0.5	Salt spray test passed
107	9.0	4.2	0.6	Salt spray test failed

Temp. 95°F., 40 volts.

Evaluation of the test panels was in accordance with the requirements established in MIL-A-8625A. According to this, "passed" means the presence of not more than a few, minute, isolated corrosion pits. In classifying the quality of the test panels, two degrees only are reported, "passed and failed," although the 28 and 62-day panels were found to be completely free from any visible signs of corrosion, and actually deserve a more appropriate classification than a mere "passed." From the data compiled in the above table, the following may be concluded:

(1) A chromium solution containing 5.2 oz./gal. free chromic acid has been found to produce an anodic film that passed the 240-hour salt spray test. The solution containing 4.2 oz./gal. free chromic acid, however, failed in film quality in this respect. From this experimentation it appears safe to conclude that a free chromic acid content somewhere between 4.2 and 5 oz./gal. is required to produce a salt spray-resistant film. Setting the minimum amount of free chromic acid in the bath at 4.5 oz./gal., no film failure was ever experienced during salt spray testing.

(2) An anodizing solution containing 4.2 oz./gal. free chromic acid failed to produce a salt spray-re-

sistant film, although the pH was found to be 0.6, a value which lies well within the range generally accepted for practical operation. Therefore, the recognized specification of the bath's acidity, expressed as 0.4-0.85 pH, appears questionable as the criterion for bath control. In other words, a bath cannot be controlled properly by determination of pH and density alone, if the film has to withstand the action of a 240-hour salt spray.

(3) It is of interest to note that, in some cases, the pH values remained the same, while the free chromic acid decreased markedly. This again confirms what has been said in paragraph (2).

Determination of the Free Chromic Acid

The free chromic acid, in the presence of chromates and trivalent chromium, is best determined by electrometric titration with N or N/10 sodium hydroxide to a pH of 3.05. The neutralization of chromic acid occurs in two steps:

$$2H_2CrO_4 + 2NaOH = Na_2Cr_2O_7 + 3H_2O \quad (1)$$

$$H_2CrO_4 + 2NaOH = Na_2CrO_4 + 2H_2O \quad (2)$$

During the first stage, at a pH of 3.05, half of the chromic acid is neutralized, and metallic chromates, if present, begin to precipitate. The endpoint depends on variables such as temperature, concentration, and composition of the solution. Therefore, it cannot be defined strictly, but lies in the pH range of 3.05-3.2. The endpoint of the second stage, when chromates are completely precipitated, also is not clearly defined, but lies in the neighborhood of a pH of 9.1. The titration, in the present case, was never carried out to this point, but was restricted to the first stage, where half of the free chromic acid is neutralized to chromate. From this titration value the total amount of free chromic acid is calculated. The analytical arrangement used for the determination is shown in Fig. 2.

Deterioration of the Bath

Deterioration of the bath is caused by the alumina-chromic acid compounds, formed during the anodizing operation, and by the trivalent chromium, both being indicated by an increase of the pH of the bath. Both compounds, as such, do not affect the corrosion resistance of the film per unit thickness produced. But, on account of the increase in pH, the current density is lowered, thus producing a thinner film, which naturally possesses a lowered corrosion resistance. In a properly operated and controlled bath, there is only little trivalent chromium present. But, if present in excess, it can be removed and avoided by making the cathode area small, which facilitates the re-oxidation to the hexavalent state. Excessive alumina-chromic acid compounds, which are the main reason for the pH increase, are removed or reduced by periodic draw-offs of the bath, and by adding new portions of chromic acid, whereby the pH is restored to the desired value.

Sealing of the Anodized Film

All electrolytically-formed coatings are porous in structure. These pores must be closed before the film becomes corrosion-resistant. This is done commercially by immersing the work in hot water, or in a dichromate solution, for a certain length of time. The quality of the water used for rinsing and later for sealing anodized surfaces is of great importance with respect to film quality. The film directly after the anodizing and before sealing is highly absorptive in this state. Chlorides and/or sulfates, when present in the processing water in amounts exceeding 0.11 g./l., have been found injurious to film quality. Anodized films which were electrolytically produced correctly and which, therefore, have the basic qualities inherent to produce a salt spray-resistant surface, may fail when water excessively loaded with chlorides or sulfates is used for the sealing operation.

Fig. 2. Analytical arrangement for the electrolytic determination of free chromic acid, showing pH-electrometer, burette, and beaker containing liquid sample under test.

This problem of poor sealing may present itself, when the water used becomes temporarily or permanently loaded excessively with solids. Therefore, when test panels show evidence of a lowered or poor salt spray resistance, one must look for an answer not only to the anodizing bath, but also to the chemistry of the water used for sealing.

Conclusion

A chromic acid anodizing bath should be controlled by direct determination of the free and combined chromic acids, when the anodic coating must meet the requirements of the 240-hour salt spray test. Evaluation of the bath by density and pH alone appears insufficient, as a poor relationship seems to exist between film quality and these values.

Excessive amounts of chlorides and sulfates, when contained in the operating water used for sealing, are deleterious in that these compounds interfere with proper sealing and, therefore, with the production of a salt spray-resistant coating.

THE ELECTROCHEMICAL SOCIETY

Abstracts of papers of interest to platers, presented at the Houston, Texas, meeting of the Society, Oct. 9-13, 1960.

Some Factors Affecting the Surface Chromium Content of Electrochemically Treated Tin Plate

By P. R. Carter (U.S. Steel Corp., Monroeville, Pa.)

The relation among current density, total coulombs, solution temperature and pH, and chromium content of the treatment film for the cathodic and the cathodic-anodic dichromate electrochemical treatments is discussed as well as the relation between film stability and the chromium content. The previous theory of what occurs during cathodic treatment in sodium dichromate solutions is modified to conform to the new data.

Copper Oxides on the Surface of Gold Plate

By M. S. Frant and R. Rajaraman (Research Division, AMP Inc., Harrisburg, Pa.)

Significant quantities of copper oxides were found on the surface of electroplated gold specimens after relatively short heating times at temperatures as low as 125°. Both cuprous and cupric oxides were measured using coulometric reduction techniques. Data are given on the effect of gold thickness, temperature, and type of deposit. The results are shown to be consistent with a mechanism involving diffusion of the copper to the surface, followed by oxidation.

Copper Sulfide Creep on Porous Electroplate

By M. S. Frant (Research Div., AMP Inc., Harrisburg, Pa.)

Creepage of copper sulfide out from pore sites on tin electroplate on copper has been found in samples returned from field use. Similar creepage has been observed in the laboratory for tin plate on copper and copper-silver alloy, for nickel and for gold on copper, for electroless palladium over nickel and brass, and for lacquered copper specimens. Moisture accelerates the growth of sulfide films in sulfur vapor at 60°.

Chemical Deposition of Palladium and Other Platinum Metals

By R. N. Rhoda (Research Lab., International Nickel Co., Inc., Bayonne, N. J.)

Ductile and adherent palladium may now be deposited reproducibly on a number of catalytic surfaces with ease. The development of this process is reviewed and recent work involving operating conditions and stabilizing of baths is discussed. Advantages of this method as weighed against its present limitations indicate early commercial adoption. Attempts to extend this method to other platinum metals are discussed briefly.

'Electroless' Deposition of Gold from Aqueous Solution on Base Metals of Nickel, Iron-Nickel-Cobalt Alloys, and Gold

By R. F. Walton (Glass to Metal Seals Dept., Semiconductor-Components Div., Texas Instruments, Inc., Dallas, Texas)

A new solution formulation for the chemical (electroless) deposition of gold is proposed. The main constituents of this solution are potassium gold cyanide, citric acid or tartaric acid, tungstic acid, and N, N-diethylglycine sodium salt. Optimum concentrations of these constituents were determined by a statistical evaluation of the solution at four concentration levels. Investigation of such variables as immersion time, solution temperature, and pH, which affect the chemical deposition of gold from solution, enabled determination of the optimum operating conditions.

Chemical Plating with Borohydrides

By E. A. Sullivan (Research and Development Labs., Metal Hydrides Inc., Beverly, Mass.)

Essentially pure nickel and cobalt have been plated on both metals and nonmetals by chemical deposition with borohydrides. The aqueous plating baths are maintained strongly alkaline (pH$\sim$12) to prevent the usual formation of transition metal borides. Deposition is initiated by warming the baths to 40°-50°C. Smooth, adherent, continuous plates of nickel and cobalt have been formed by this method, particularly on nonmetals such as ceramics, plastics, and glass.

An Electroless Copper Plating System for 'Pure' Aluminum

By S. L. Matlow (Hoffman Electronics Corp., 1001 Arden Drive, El Monte, Calif.)

A method has been found for displacement plating copper onto "pure" aluminum. The aluminum is first cleaned in perchlorethylene and NaOH baths, then given a sensitizing dip in acidic $CuCl_2$. The plating done in an ammoniacal solution of $CuCl_2$, adheres quite well and is self-fluxing on soldering. The solder bond formed by this process is found to be stronger than the aluminum itself as determined by soldering two B&S gauge No. 14 aluminum wires together with a ¼ in. overlap. When placed under tension, the solder-copper and the copper-aluminum bonds do not fail; the wire breaks instead.

Mechanisms of Electroless Deposition of Metals on Silicon

By S. L. Matlow (Hoffman Electronics Corp., 1001 Arden Drive, El Monte, Calif.)

Studies on the electroless deposition of metals onto silicon indicate that there are at least four independent mechanisms by which the deposition can occur. These are (*a*) displacement plating, (*b*) displacement-replacement plating, (*c*) autocatalytic, homogeneous, and (*d*) autocatalytic-heterogeneous. These mechanisms can be distinguished by the apparent rate laws which are obeyed and by the nature of the metallic deposit. Examples of each case are discussed. Except for case (*c*) details of the mechanisms and the experimental data on which they are based are discussed.

Some Observations of Copper Deposits on Single Crystals of Copper

By I. B. Giron (Guest Worker from Lima, Peru) and Fielding Ogburn (National Bureau of Standards, Washington, D. C.)

Isolated faces of copper single crystals were plated with

copper from sulfuric acid-copper sulfate solutions. Metal distribution and topography of the deposits were observed, cross sections were examined microscopically, and x-ray diffraction patterns were obtained. Topography was characteristic of crystallographic plane. Deposits giving diffraction patterns showing uniform orientation were found to contain grain boundaries associated with topography features. Over-all metal distribution showed a tendency to deviate from normal current distribution toward establishment of a more closely packed plane.

Electroplating of Silver onto Aluminum

By V. A. Nelson (Research Labs., Allis-Chalmers Manufacturing Co., Milwaukee, Wis.)

A method for plating silver onto aluminum by means of a mercury immersion coating has been developed and can be used with conventional plating equipment. Corrosion, mechanical, and electrical tests show that the resulting plates are of comparative quality to present commercial plates. Aside from conventional cleaning, the new plating procedure requires only two chemical baths and one electrochemical operation. The new plating procedure permits aluminum to be silver-plated even more conveniently than copper.

Porosity Measurements on Gold-Plated Copper

By M. S. Frant (Research Div., AMP Inc., Harrisburg, Pa.)

Using a chemical porosity test (in which the specimen is exposed to an ammonia-ammonium persulfate solution which attacks copper but not gold, so that the amount of copper dissolved is a measure of the porosity of the coating), the conventional cyanide gold bath and 6 proprietary baths were compared for porosity. The relationship between porosity and thickness was found to be $P = at^{-n}$, where P is chemical porosity, a varies for each bath, t is gold thickness, and n generally varies between 1.3 and 2. A linear relationship, with a slope close to 1, was found for the variation of porosity with current density in both alkaline and acid baths.

Electrodeposition of Cobalt-Molybdenum Alloys

By Albertine Krohn and T. M. Brown (University of Toledo, Ohio)

Previous studies showed that iron-molybdenum alloys could be deposited from pyrophosphate solutions. This investigation shows that a similar bath can be used to deposit cobalt-molybdenum alloys. The addition of hydrazine sulfate to the plating bath prevents anodic oxidation of Co(II) to Co(III). It also causes an increase in the cathode current efficiency and an increase in the molybdenum content of the deposits. Efficiency is further increased by wiping the cathode during plating.

Composition and Thickness Effects on Magnetic Properties of Electrodeposited Thin Nickel-Iron Films

By Irving Wolf (Electronics Lab., General Electric Co., P. O. Box 1122, Syracuse, N. Y.)

Thin films of nickel-iron have found use in the fabrication of magnetic memories for information storage in computers. These memories have the advantage of very high speed switching. Use is made of a magnetic field during deposition to align the magnetic axes in the film in one direction so that the film exhibits a single "easy" axis of magnetization. Thus an "induced" anisotropy is established. In this work, effects of thickness (500-6000Å) and composition ($\sim$60% Ni-100% Ni) on the anisotropy field, H_k, as well as on wall coercive force, H_c, and easy direction disturb, H_e, are presented. Evidence for stress interaction with magnetization and some data on substrate roughness are given.

Effect of Plating Parameters on the Structure and Magnetic Properties of Co and Co-Ni Alloys

By I. M. Croll and H. F. Quinn (IBM Federal System Div., Owego, N. Y.)

Electrodeposited Co and Co-Ni alloys have been prepared under a wide range of plating conditions in an attempt to correlate specific bath conditions with grain orientation, grain size, and microstrain in the deposits. Striking changes in the texture of deposits prepared from simple baths have been found to occur in a critical pH region (3.5-4.0). Extreme preferred orientation has been obtained in deposits plated under combination a-c and d-c conditions. Specific ferromagnetic properties of the deposits are correlated with their structure.

Electrodeposition of Nickel-Cobalt Alloys from the Pyrophosphate Bath

By Vasanta Sree and T. L. Rama Char (Electrochemistry Lab., Dept. of Inorganic and Physical Chemistry, Indian Institute of Science, Bangalore, India)

Nickel has been codeposited with cobalt from the pyrophosphate bath. Detailed studies on alloy composition, cathode efficiency, and potential have led to the optimum conditions for obtaining satisfactory alloy plates with 10-91% nickel. The efficiency of cast alloy anodes is quite high. X-ray patterns of the deposits show the existence of fcc and hexagonal structures. The deposit composition could be altered appreciably only by varying the metal content of the bath.

Electrodeposition of Pure Copper

By Sidney Barnartt (Research Labs., Westinghouse Electric Corp., Pittsburgh 35, Pa.)

Previous methods of purifying copper by electrodeposition have involved alternate electroplating and melting steps. A highly simplified procedure consisting of electrodeposition from an acid sulfate solution pretreated with sodium sulfide is described. Analytical data and residual resistivity measurements at liquid helium temperatures are presented.

The Electrodeposition of Cermets

By J. C. Withers (Chemistry Dept., American and Foundry Co., 1025 N. Royal St., Alexandria, Va.)

Cermets can be electrodeposited by suspension of the ceramic particles in a conventional electroplating bath. The amount of ceramic codeposited is strongly dependent on the ceramic particle size, method of suspension, and the cathode current density. Cermets of chromium, nickel, cobalt, tungsten, platinum, and rhodium with Al_2O_3, $MoSi_2$, ZrO_2, and SiO_2 have been prepared for use as high-temperature materials such as coating and structural bodies.

Effect of Organic Compounds on the Codeposition of Hydrogen with Nickel

By J. R. Goodwyn (present address: Texas Eastman Co., Longview, Texas) and T. C. Franklin (Chemistry Dept., Baylor University, Waco, Texas)

The codeposition of hydrogen with nickel has been studied in a Watts bath to which various organic compounds were added. Using a coulometric method to measure the amount of hydrogen codeposited, it has been shown that generally the concentration of additive which produced the brightest deposit also produced the deposit containing the least amount of hydrogen. A possible explanation for the curves relating the hydrogen content and the additive concentration is provided by electrode potential data.

Mechanism of Addition Agent Reaction in Bright Nickel Deposition

By S. E. Beacom and B. J. Riley (Research Labs., General Motors Corp., 12 Mile and Round Rds., Warren, Mich.)

Organic addition agents synthesized with C-14 as well as S-35 have been used in a continuing study of the leveling phenomenon associated with the deposition of bright nickel. Analysis of deposits and the gaseous products of deposition have led to speculations concerning the breakdown of addition agents and the possible interactions which may account for the synergistic effect of leveling brought about by combinations of addition agents. Studies have shown that the

amount of breakdown products is related to current density and polarization.

Electrodeposition of Iridium

By E. L. MacNamara (Pitman-Dunn Labs., U. S. Army Ordnance Arsenal, Frankford, Philadelphia 37, Pa.)

The requirement of high-temperature stable protective coatings in certain military applications has focused attention on the Platinum Group Metals. The properties of iridium are of particular interest. Procedures for the aqueous deposition of rhodium, palladium, and platinum are fairly well established. The only successful method reported for the deposition of iridium utilizes molten salts. Experiments at this laboratory have demonstrated that iridium can be plated from aqueous solution containing quadrivalent iridium. Bright, tenacious deposits are obtained with a cathode efficiency of 12% at these optimum conditions; metal content, 10 g./l.; current density, 20 amp./ft.^{2}; temperature, 60°C.

Electrodeposition of High-Purity Chromium from Electrolytes Containing Fluoride or Fluosilicate

By N. E. Ryan (Aeronautical Research Labs., Australian Defense Scientific Service, Dept. of Supply, Melbourne, Australia)

Investigation of the variables affecting the laboratory scale deposition of chromium from chromic acid electrolytes containing fluoride or fluosilicate has enabled the optimum conditions for the production of high purity chromium (0.03-0.04 wt% oxygen 0.0008-0.0002 wt% nitrogen) at the highest current efficiency (38-45%) to be determined. This current efficiency is much higher than the 8-10% in the chromic acid-sulfate electrolyte in which chromium of a similar grade can be produced. Continuous electrodeposition in a larger cell showed that the current efficiency in fluoride-containing electrolytes decreased progressively with time to a steady 25-30%. No explanation has been found for this decrease. After steady conditions have been achieved the advantages in current efficiency of the fluoride over the sulfate bath remains substantial.

Measurement of Stress in Very Thin Electrodeposits

By H. Watkins and A. J. Kolk (Electronics Div., National Cash Register Co., Hawthorne, Calif.)

A modified form of the Brenner-Senderoff contractometer is described. Greater sensitivity is achieved by using jewel bearings and optical read-out. The sensitivity is sufficient to determine a 10 KSI stress in a 200Å film. This instrument has been used to study the initial growth of the plating in thin electrodeposited films of iron-nickel alloys. Electron micrographs of the films were made to help in interpreting the stress data.

Influence of Thiourea on the Deposition of Iron-Nickel Films

By R. D. DeMars (IBM, Research Center, Poughkeepsie Lab., P. O. Box 390, Poughkeepsie, N. Y.)

The deposition reactions of iron and nickel were studied polarographically in solutions containing the metal ion and potassium chloride and the metal ion, potassium chloride and thiourea. Analysis of the polarographic waves using Koutecky's method yielded values for the kinetic parameters, αn_a and $k^0_{r,h}$, for the reduction reactions. The effect of temperature and thiourea concentration on these parameters was studied. These results can lead to predictions about the composition of films plated from similar solutions. The predictions are substantiated by a series of plated iron-nickel films.

Influence of Substrates on Thin Magnetic Films Electrodeposited in a Magnetic Field

By M. Lauriente and F. X. McNally (Air Arm Div., Westinghouse Electric Corp., Baltimore 3, Md.)

An investigation was made of the influence that various substrates have on the magnetic properties of thin magnetic films of nominal composition 80Ni-20Fe, electrodeposited in a magnetic field. Included in the study were chemically reduced silver, copper-clad laminate, and sputtered, vacuum evaporated and fired gold. Electron micrographs and magnetic measurements were used to explain some of the unusual magnetic characteristics which were found.

Impregnation, Paint-Base Coatings of Magnesium Alloy Castings

A PROCESS that combines impregnation and paint-base coating of magnesium-alloy castings in a single operation has been developed by *The Dow Metal Products Co.*, a division of The Dow Chemical Co.

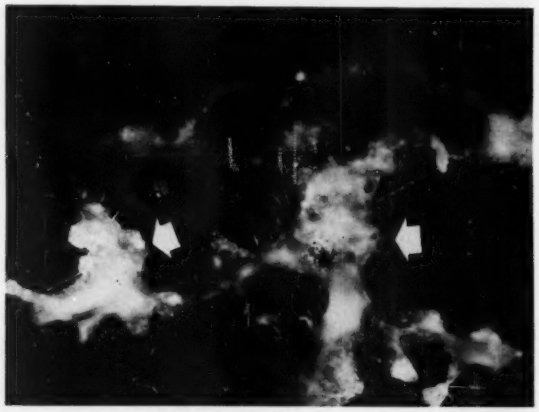
The new process is a modification of the standard Dow 17 anodize treatment. Regular procedure provides a paint base but does not seal all of the porous areas of coatings. The modification consists of allowing a swell or current "dribble" of 20 to 30 minutes, constant voltage at the end of the normal anodization period. During the dwell, anodizing continues primarily in the pores of the casting, sealing even minute pores effectively. The resulting seal will withstand air or water pressure of at least 40 pounds and heating to at least 700°F.

The complete anodizing-impregnation process is as follows:

1. Cleaned and bake-dried castings are placed in a standard Dow 17 electrolyte and anodized using either alternating or direct current. Final voltage varies from 60 to 95 volts, depending on the alloy and coating thickness desired.

2. At the end-voltage requirement for formation of the paint-base coating, the voltage is held constant for an additional 20 to 30 minutes. During this period the current flow will gradually recede to a low current level. The procedure for applying a thin coating, which uses a lower voltage than for full coating, will provide sealing except in cases of extremely coarse porosity.

3. Castings are removed from the electrolyte, water rinsed and dried.



Photomicrograph (250X magnification) of magnesium casting (AZ63A alloy) shows anodize impregnating pores (arrows) and surface of casting. Black area is plastic mounting compound.

Science for Electroplaters

61. Adhesion Tests

By L. Serota

IN determining a suitable method for the measurement of the degree of adhesion of electrodeposits, there is a need for a simple nondestructive test, one that could be applied quantitatively, especially for thin layers to, as W. Blum suggests, about one per cent of the finished products. A. L. Ferguson expresses the view that an individual test for adhesion for each different plating operation should be developed, one which could indicate the necessary adhesion requirements for the expected life of the part. An added difficulty, B. P. Finkbone indicates, is the fact that adhesion of the coating be determined in absolute units. This latter condition accounts for the varied tests, both qualitative and quantitative.

The need for a practical method for determining adhesion of the coating was emphasized by F. C. Mesle. The example cited, referred to a case where 29 per cent of 52 autos he inspected had rusty bumpers due to poor adhesion. In eleven of the 29 per cent group of cars, the plate could be peeled with the fingers. The thickness of the deposits ranged from 0.0005″ to 0.002″. The significant phase of these results, Mesle notes, is the fact that, though quality specifications for thickness were fulfilled, the deposits were poorly adherent.

Test methods commonly employed for the determination of adhesion of the electrodeposit entails deformation of the basis metal and the effect observed upon the deposit. Such mechanical distortion is generally accomplished by bending, twisting, grinding, sawing, and hammering. Separation or peeling of the plate from the basis metal, accordingly, would merely indicate whether or not the deposit adheres under the conditions tested, a test qualitative in nature. A. Brenner implies that such qualitative tests are not suitable for coatings 0.001″ thick since such thin deposits may be too weak to withstand the stress of separation from the basis metal.

H. C. Schlaupitz and W. D. Robertson offer the following instructions for measuring the desired properties in an adhesion test: (a) the loading force should be applied as a simple tensile loading, perpendicular to the interface; (b) a solid cylindrical disc is to be prepared, since one of the stresses then acts along the axis of the cylinder, with the other two radial and tangential; (c) test specimen design should allow for minimum stress concentrations at interface; (d) interface stress should approach a condition wherein the three principal stresses are tensile in nature and equal in value since, in such arrangement, the authors note, plastic flow will not result; (e) stress on either side of interface should be the same. In Fig. 240, diagram on the left represents a non-symmetrical arrangement-deposit on one side of the basis metal, while the diagram on the right, with deposits on both sides of the basis metal, corresponds to the preferred symmetrical arrangement; (f) placing of the specimen should be such that failure will occur at the interface; (g) ideal adhesion tests would require both basis metal and deposit to be as thin as possible, with the gripping device not affecting the adhesive strength.

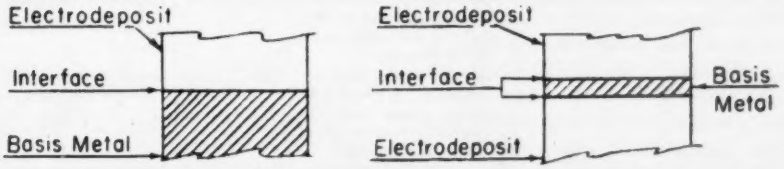


Fig. 240. Arrangement of material in the vicinity of the interface. Left, nonsymmetrical arrangement in usual adhesion test; right, desired symmetrical arrangement, with the ideal approached as the thickness of the basis metal approaches zero.

A. Brenner and V. D. Morgan cite as a problem in determining the degree of adhesion in production operation, particularly without adequate laboratory control, the fact that the bond at the interface, which may be as strong as the tensile strength of the weaker metal, may produce a rupture of the area of the interface, in breaking.

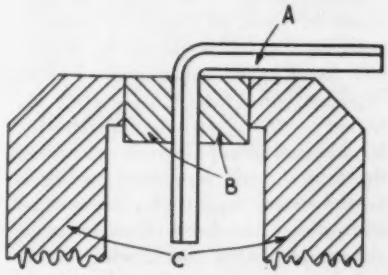


Fig. 241. Method of applying bend test to electroplated strip.

For many practical purposes, Schlaupitz and Robertson suggest that qualitative tests, such as bending or twisting, may be considered satisfactory for determining the adhesion of an electrodeposited metal. A. L. Ferguson considers the bend test the most commonly used test by practical platers.

Bend Test

This method was used by R. J. Piersol for laboratory tests of adhesion on thin strips. A soft iron strip, with electrodeposited plate, about 20 mils thick, is placed in a vise (Fig. 241) and bent back and forth. The index of adhesion is represented by the number of times bending is required for the plate to peel from the strip. When adhesion is very good the strip may break before loosening of the plate occurs at the bending point. In the diagram, A is the plated strip, B the rectangular hard wood block, C the jaws of the vise.

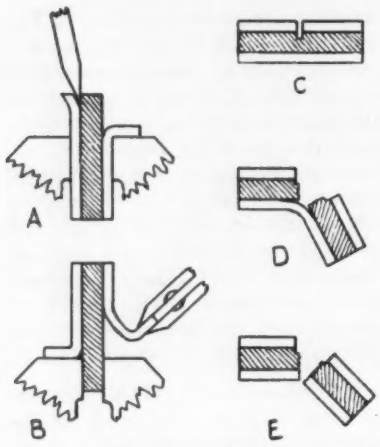


Fig. 242. Hothersall's bending test for adhesion of electroplate.

Classification of qualitative measurements in terms of degree of adhesion was made as follows by A. W. Hothersall, based upon studies made of nickel deposited on brass: (a) slightly adherent — the deposit is first detached by a chisel, then pulled off easily with the fingers; (d) moderately adherent — the nickel deposit can be detached with pliers; (c) fairly strongly adherent — pull with pliers, which is insufficient to remove deposit, requires in addition detachment by twisting, as with a can opener; (d) strongly adherent — separation by chisel partially effective, the chisel cutting through the deposit or basis metal; (e) very strongly adherent — separation of deposit from basis metal is not effected by the methods cited.

For the qualitative adhesion tests upon which Hothersall based his classification, the basis metal sheet should not be in less than 0.03″ thick and the nickel deposit (on both sides) not less than 0.02″. Brenner and Morgan indicate that qualitative tests involving procedures that entail deformation or chisel and hammer methods for detaching a plate are not suitable for thin coatings 0.001″ thick, since such deposits are too weak to withstand stress of separation. The aforementioned tests are demonstrated by diagrams A. to E in Figure 242.

Prior to testing, the edges of the coated sheet are either sawn or sheared off and filed smooth. A represents the hammer and chisel test (in Fig. 242) for detaching the deposit; B, the tongue of the deposit is gripped with pliers and a pull or twist test may be made; C, when detachment cannot be effected by the above methods, a saw cut is made in the sample; D, separation occurs on bending and, when adhesion is not very high, chisel test may be added; E, example of strong adhesion — no separation, on bending, at the fracture.

G. E. Gardam, in his investigation of the adhesion of chromium deposits on basis metals in engineering applications, and of the deposits of metal such as nickel on chromium or stainless steels, emphasized the importance of testing such plated metals by qualitative or quantitative methods. The method employed for qualitative tests entailed removal of the edge of the test piece, starting the separation with a chisel, then gripping the separated layer with pliers.

The deposition of nickel on chromium was effected by cathodic treatment of the chromium plated surface in a strongly acid solution containing nickel sulfate. This procedure, Gardam notes, serves to remove the oxide film from the chromium surface and, at the same time, deposit nickel. Subsequent plating to the desired thickness of nickel is performed in a standard nickel bath. A copper coating between the two nickel deposits is suggested where high adhesion is required.

Included in this study was the effect upon the adhesion of chromium to various basis metals, of the method of surface treatment prior to chromium deposition (Table 1). Good adhesion of chromium, it is noted, is obtained on smooth or polished metals by wiping with a cloth.

An effect of this qualitative test, involving forceful separation of the basis

TABLE 1.—QUALITATIVE TESTS OF ADHESION OF CHROMIUM TO VARIOUS METALS

No.	*Basis Metal*	*Treatment preparatory to Chromium Deposition*	*Adhesion*	*Position of Fracture*
1	Brass, nickel plated and polished.	Careful wiping with a soft cloth.	Good	In copper layer.
2	Ditto	Cathodic alkali treatment in solution of commercial purity. Time at 150 amp. per sq. ft.:		
		2 mins.	Fair	Chromium Nickel interface.
		5 mins.	Poor*	
		10 mins.	Poor*	
3	Ditto	Cathodic alkali treatment in pure solution using platinum anode. Time at 150 amp. per sq. ft.:		
		2 mins.	Fair to good	Mostly in chromium layer.
		5 mins.	Fair to good	
		10 mins.	Fair to good	
4	Ditto after standing 24 hrs. in dry air.	Careful wiping with a soft cloth.	Good	In copper layer.
5	Ditto after standing in laboratory for 24 hrs. (polish visibly fogged).	None	Poor*	Mostly at chromium-nickel interface.
6	Brass, bright nickel plated.	Rinsed after bright nickel plating.	Good	Partly in nickel layer on brass.
7	Mild steel machined to a smooth finish.	Careful wiping with a soft cloth.	Good	In chromium layer.
8	Mild steel	Anodic action in chromium plating solution at 48°C., 200 amp. per sq. ft., followed by immersion in solution without current for 1, 2, 4 & 16 hrs.	Good	In chromium layer.
9	Polished elinvar	Careful wiping with a soft cloth.	Good	In chromium layer.
10	Chromium plated steel	Immersed in chromium plating solution at 48°, current switched on after 6 minutes.	Poor or nil	Junction of two chromium surfaces.
		Immersed in distilled water at 62°C., for 5 minutes, then rapidly transferred to chromium plating bath.	Fair	Junction of two chromium surfaces.
		As above, but temperature of water 75°C.	Fair	Junction of two chromium surfaces.

*Chromium deposit partially exfoliated.

metal and adherent deposit on chromium, was the fracture in the chromium or copper layer. For this reason, Gardam uses the following terms to represent degree of adhesion, instead of those applied by Hothersall: poor adhesion — deposit pulled off with fingers; fair adhesion — deposit pulled off with pliers, fairly clean separation from basis metal; good adhesion — deposit removed from basis metal, failure occurring in chromium or copper layers.

Hammer Test

A variation of the hammer test, developed by R. J. Piersol, is the impact method of testing adhesion of electrodeposits. The machine was devised to test thick plates of chromium deposited on non-flexible basis metal. The sample, labeled A in Fig. 243, is held in position against the impact block B. Impact hammer C swinging as a pendulum, with D serving as the pivot of the arm, will strike against the specimen. Adhesive strength is measured in terms of blows required to separate the chromium plate.

A practical method of determining plate adhesion for hard chromium plated articles, introduced by H. Chessin and J. G. Poor is a test with a minimum of destruction, hence suitable for many production items where a small indentation is not objectionable. The test depends upon indentation of the chromium plate to a predetermined depth, with a small indenter having a hemispherical end. A good bond will not show any effect (swelling) around the periphery of the indentation (Fig. 244). When the bond is poor, the chromium coating at the edge of the indentation will spall (chip) or peel away in flakes from the basis metal, or indicate peripheral swelling

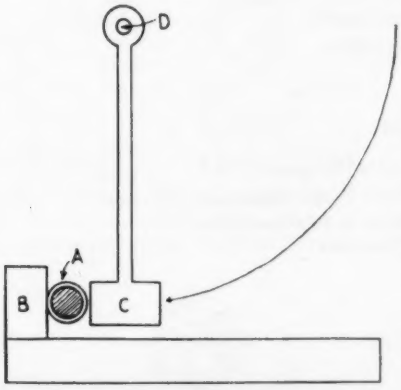


Fig. 243. Impact method of testing adhesion of electroplate.

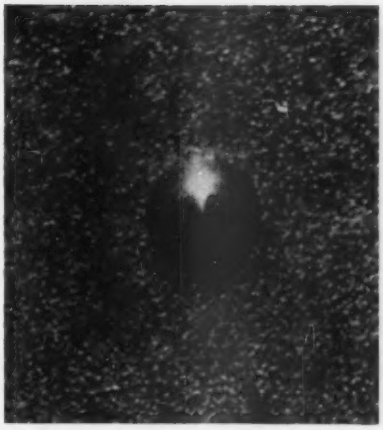


Fig. 244. Good Bond.

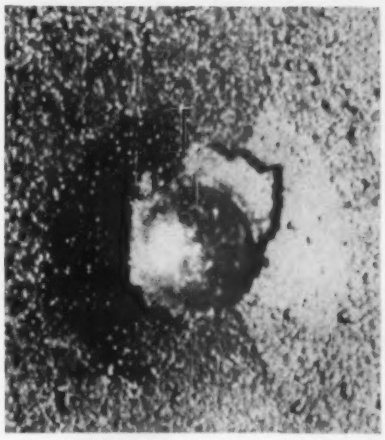


Fig. 245. Poor bond. Swelling with spalling.

with the appearance of a volcanic cone (Fig. 245). Results are best obtained with the use of a low-magnification microscope.

Two hemispherical indenters were found to be most satisfactory. One with a $\frac{1}{16}$″ radius gave an indentation to a depth of 0.025″ producing a circular hole 0.100″ in diameter. The other, with a $\frac{3}{64}$″ radius, is indented to a depth of 0.020″ with a circular hole 0.077″ in diameter in the chromium plated surface. Too great depth of penetration, it was found, will cause excessive deformation. The authors express the view that this test could be extended to other electrodeposits besides the chromium deposits on ferrous metals, with variations, of course, in depth of penetration and penetrator size for different electrodeposits and basis metals. It is further suggested that penetration of flat or outer surfaces, with some modifications, could be made with an indenter unit, such as the Rockwell-type hardness tester, or even a simple screw arrangement.

Twist Test

A twist variation of the bend test for determining adhesion qualities for electrodeposits (principally nickel) on aluminum, developed by G. B. Brook and G. H. Stott, provides specific dimensions of the strip and bending rate as a measure of standardization. Poor deposits resulting from blisters, which may occur on the deposited surface of the aluminum in time, leading to easy peeling, are attributed by the authors to the failure to obtain an oxide-free surface with the deposition of the first film, or the porosity of the deposit, which is a source of undermining and loosening of the metallic film.

Essentially, a standard strip 8″ x ½″ is twisted at a uniform rate around a ½″ bar held in the chuck of a precision lathe revolving at 20 r.p.m. To produce the twist effect, the strip is held in the bar by a slot, and gripped at the other end with pliers, as the lathe rotates.

Results with six test pieces of deposits on aluminum base are shown in Fig. 246: No. 1, dull nickel, plate stripping and basis metal cracked but not fractured; No. 2, polished nickel, plate badly stripped, basis metal brittle, broken; No. 3, polished nickel, no cracking, No. 5, rough nickel, plate peeling in different parts, basis metal not cracked; No. 4, rough nickel, plate stripping; basis metal cracked, but not

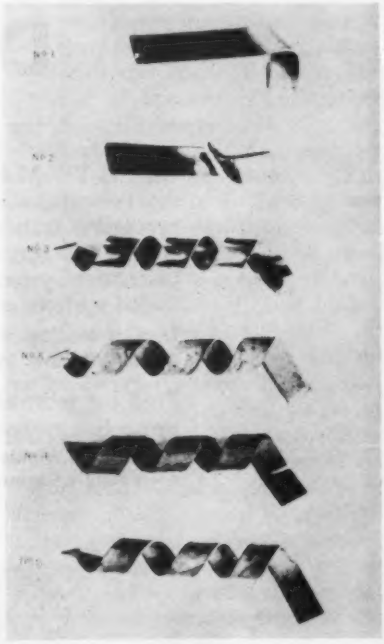
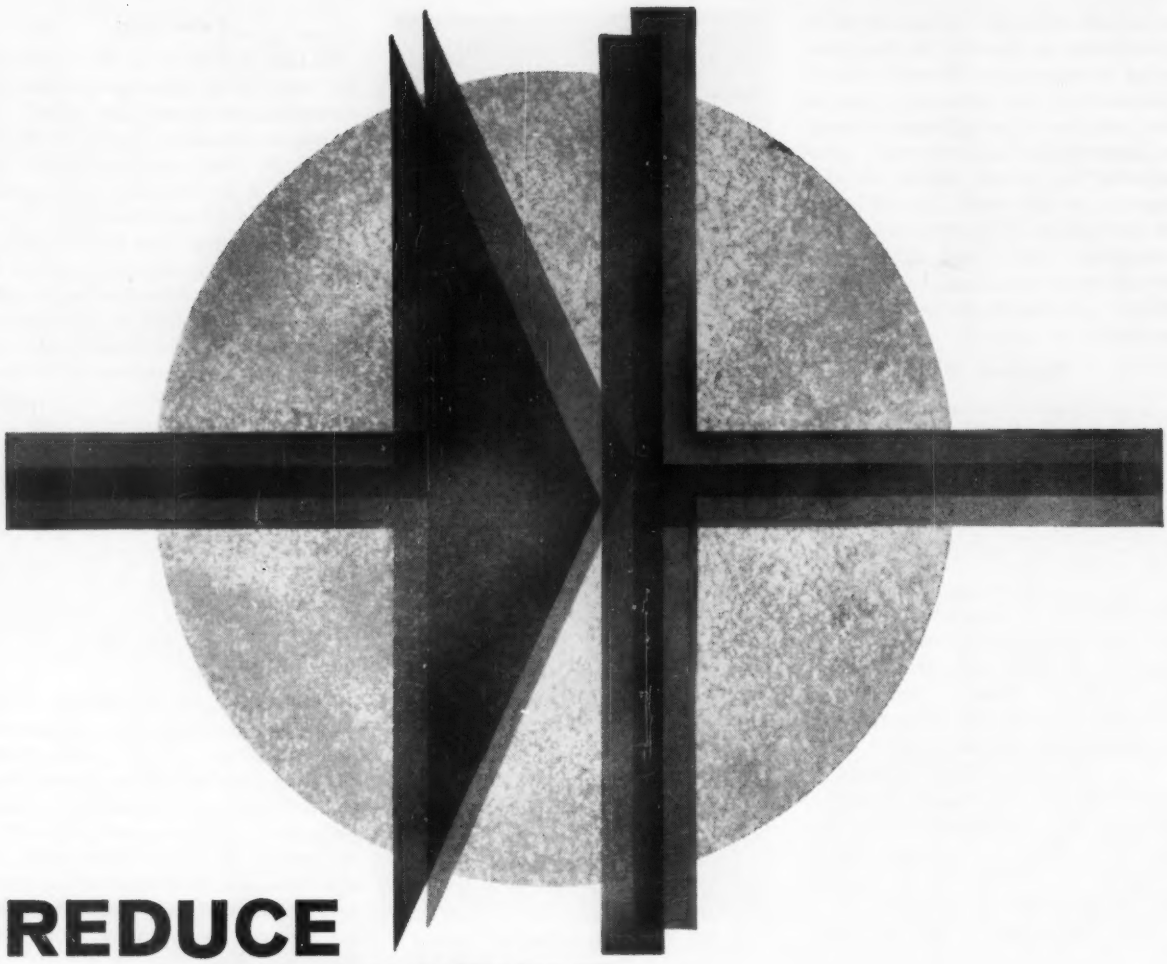


Fig. 246.



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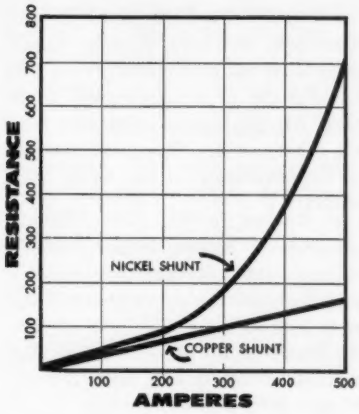

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fractured; No. 6, copper (dull) on nickel, no cracks, no peeling.

Of twelve plated strips tested, six showed no failure from cracking or peeling, one had fine hair cracks, with five giving definite indications of rupture of the plated film. Tests with single metal deposits (such as nickel on aluminum), it was found, generally showed stripping, peeling and, in some cases, cracking. Multiple deposits on aluminum, such as copper on nickel, or chromium on nickel on copper, gave almost perfect results.

Although satisfactory results were obtained by this test method, it is suggested that consideration must be given to establishing a standard temperature, one that would not promote blistering or peeling of the deposit, as well as standards for pure aluminum and alloys. The temperature used, 430°C., was interpreted as serving, essentially, to develop an intermediate alloy between the deposit and base.

Heat Test

One of the earliest qualitative tests applied for determining adhesion is the heating test. This method has the advantage that it is non-destructive for the piece tested. The heating may expand adsorbed or occluded gas or liquid beneath the plate (at the interface) or on the basis metal, with the formation of blisters resulting in cases of poor adhesion. Entrapped liquids may vaporize upon heating, hence, producing the same effect of lifting the deposit away from the basis metal. Pronounced changes in temperature, in cases where the coefficient of expansion for the basis metal and deposit are quite different, will cause the plate to loosen or peel.

An application of this method is cited by F. M. Dorsey, where nickel deposited by the Madsenell process adheres under bending stress, even when heated to 1000°C., then plunged into cold water. The bond between the basis metal and nickel will not be affected by blistering. In the Madsenell process, the metal is degassified before it is subject to electrodeposition. A soft, ductile, annealable nickel coat may thus be obtained.

The basis metal (iron or steel) is made the anode in a bath containing 66°Bé sulfuric acid at room temperature. When the acid concentration is less than 85.4 per cent the bath does not work very well. A steel cathode is used. Best operating conditions are obtained at 12 volts with direct or alternating current. The process is not considered just a pickling operation, because foreign matter, deeply imbedded during fabrication, is removed. The process produces a fine etching of the metal surface so that crystal growth of the plated metal is enhanced.

Another example of the heating test for adhesion is mentioned by R. Yates in the electrodeposition of nickel on aluminum mold castings. Heating to 800°C. and plunging into cold water did not disturb the adhesion of the deposit on the specimens.

Black Light-Fluorescent Test

The black light or fluorescent test has regained attention in recent years as a test to show the absence of a bond (poor adhesion) at edges of plated parts since, because of the release of pressure, blistering may not occur at such area. Essentially, the test entails machining of the edge to give a clean interface, then immersing the sample in heated paraffin, cooling without removing the oil, wiping off the surface oil with a rag when, upon reheating, any paraffin which has been absorbed in cracks or pinholes will appear as oil droplets which will fluoresce upon exposure to ultra-violet light. A. L. Ferguson considers this test as one relating to porosity rather than degree of adhesion. The test, however, will show the absence of a bond at the edges of a plated sample.

Burnishing

The qualitative test of burnishing is generally accepted by the silver platers as a satisfactory test for adhesion. The operation of burnishing, S. Wernick indicates, will show local poor adhesion, by blistering where it may not be readily detected otherwise. Adhesion, according to B. Egeberg and N. E. Promisel, may be considered satisfactory if the burnishing tool when applied with a pressure of twenty-five pounds, does not cause blistering or lifting of the plate.

A. Hirsch describes a barrel burnishing process for testing the adhesion of nickel deposits. A total weight of 900 pounds of $\frac{7}{32}$″ steel diagonals in a barrel 16″ by 30″ in diameter revolving at 20 r.p.m. would cause poor adhesion (nickel deposits) to "shell" off the basis metal as soon as the burnishing was started; whereas good adhesion would not be affected (shelled) even after an extended period of the burnishing operation.

SHOP PROBLEMS

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Copper Determination with EDTA

Question: We have recently subscribed to your magazine, METAL FINISHING, through your Sydney agent and are looking forward to receiving it regularly.

Would it be possible for you to send me, if available, a method for the analysis of metallic copper in copper cyanide solutions using EDTA.

G. H. E.

Answer: The following procedure was suggested by Gutman (Plating, **43,** 345, 1956):

To a 2 ml. sample of plating solution add 10 ml. sulfuric acid and heat to boiling. Add 10 ml. 30% hydrogen peroxide and heat to fuming.

Cool, add 100 ml. water and 30 ml. ammonia. Cool to room temperature and add ½ g. Murexide indicator mix (0.2 g. ammonium purpurate + 100 g. sodium chloride). Titrate with 0.05 M. EDTA solution until a purple color appears. The EDTA is standardized against metallic copper.

The Murexide indicator mix should be stored in the dark.

Rinse Water Temperature

Question: We have the perplexing problem, and subsequent conflicting of opinions, on the effect of the temperature of the first rinse water on the continuity of quality of cadmium electrodeposited coatings. Perhaps through your contact in METAL FINISHING, Shop Problems, you could effect the solution to our problem.

The cadmium plating applications are in a barrel plating line, still tank and small automatic operation. The temperature of the flowing cold water rinses vary between 90°-110°F. Is this the source of execessive water streaking, and coating discoloration?

The return to a cooler temperature cold water rinse, say 75°F., will require only a minor material expense; however, is it necessary? The change to the warm water supply was done as an economy move.

A. R. R.

Answer: Operation of rinse tanks at a temperature of 90-110°F. would have no influence on water-streaking and coating discoloration.

These conditions may be due to contaminated rinse water and plating solution. Also, in barrel plating, there is a problem of rinsing the loads effectively which, due to their packing, is not always complete.

Ultrasonics in Bright Nickel

Question: Can you furnish any information of the effect of ultrasonic vibrations in bright nickel plating? Would this be a preferable form of agitation, despite the assumed much higher cost of equipment?

L. F.

Answer: The following results have been obtained in bright nickel baths:

1. Cathode efficiency was slightly higher, as was the limiting current density.

2. Porosity due to hydrogen evolution was decreased, especially at high current densities.

3. Deposit hardness appeared to increase with increasing wave frequency.

4. Brightness was good at low frequencies but streaks were produced at very high frequencies.

Delayed Fracture of High Strength Steel

Question: We would appreciate any information you can provide in connection with delayed fracture susceptibility of plated high-strength steel of the 4340 type.

Q. P. R.

Answer: Delayed fracture or "static fatigue" is associated with hydrogen embrittlement and, usually, the higher the strength of the steel, the less effective is the usual bake at 350-400°F. This holds true for cadmium and zinc but not for chromium deposits.

It has been found that a 350°F. bake for 24 hours removes the susceptibility of these steels to delayed fracture after they have been chromium plated, but is ineffective in the case of zinc, and is only partially effective for cadmium plate.

Phosphating Iron and Steel

Question: I've been reading numerous articles on phosphating iron and steel and the processes appear to be legion. Are all these so different from each other, or are they modifications and improvements of the same basic formula?

C. T.

Answer: A recent British standard separates the phosphating methods into five classes for convenience. These are as follows:

1. Heavy zinc phosphate coatings for good protection and rapid coating, 700 mg./ft.^{2} or more.

2. Medium-weight coatings, used as a base for oils, waxes, greases and paints, zinc or other metal phosphates, not less than 400 mg./ft.^{2}

3. Lightweight coatings, used as a paint base. This class includes most of the spray type, accelerated zinc phosphate processes, although other metal phosphates can be used. Weight is 100-400 mg./ft.^{2}

4. Extra-light-weight coatings, essentially iron phosphate, 30-100 mg./ft.^{2}, used as a paint base on thin gauge sheet steel, where the organic finish has good protective value. This class includes most of the spray-type alkali-metal phosphate processes.

5. Heavyweight manganese phosphate or manganese-iron phosphate coatings, 700 mg./ft.^{2} or more, for maximum protection.

Nickel Plating on Chromium

Question: From time to time I have to nickel plate parts which have a chromium finish and, even though I use the standard nickel chloride strike, I have been experiencing peeling on a

large percentage of the work. I find this strike very unsatisfactory for my purpose since, although most of the parts look good after plating, the adhesion becomes very bad on heating. Is there a better way to get good adhesion on chromium, that I can use?

D. N.

Answer: A procedure was recently suggested by Reid and Ogburn for obtaining adherent nickel plate on chromium, used to protect molybdenum at high temperature. The chromium surface is etched in glacial acetic acid containing about 15% by volume sulfuric acid for conductivity. Reverse current is used until a uniform dark brown film appears, which takes about 5 minutes at 40 amp./sq.ft. The part is rinsed and immediately placed in the nickel chloride strike with the current on. After striking for 2-4 minutes at 250-300 amp./sq.ft., the parts are plated in a Watts nickel bath.

Cheap Rose Gold

Question: How can we produce a cheap rose gold color on our novelty earrings? Our present method is to use an old gold plating solution with 12 volts to produce the antique smut. We then relieve the highlights by scratch brushing lightly, and then flash in a 24 Kt. cyanide tank. Naturally, the smut is pure gold, and most of it is removed in the relieving, so that the cost of finishing the items is very high, compared with the usual bright gold plate. In order to be competitive, it is necessary that the plating cost be cut to a minimum.

O. J.

Answer: The smut can be produced without the use of gold. For example, a standard cyanide copper bath, operated at room temperature and high current density will be suitable. Another suggested smut bath is as follows:

Copper cyanide	3	oz./gal.
Sodium cyanide	3	"
Zinc cyanide	¾	"
Silver cyanide	1/10	"
Soda ash	3	"

The articles are plated in this bath at room temperature and 6 volts. If a darker smut is desired, dissolve some lead acetate in caustic soda solution and add cautiously until the desired degree of darkening is obtained. Most suppliers of gold plating salts and solutions can also furnish low-cost smutting mixtures.

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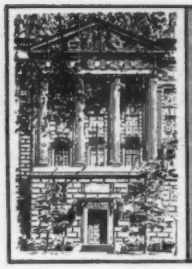

Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD

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Automatic Finishing Machine

U. S. Patent 2,935,822. *May* 10, 1960. *A. G. Winchester, H. E. Hortman, Jr., and G. Cummins, assignors to Buffing, Incorporated*

A work-finishing machine comprising in combination, a plurality of drive stations and a plurality of finishing stations, each finishing station providing a particular step in the finishing operation and each such step being correlated to produce desired end results.

Hot Tinning

U. S. Patent 2,935,963. *May* 10, 1960. *S. Aamot, assignor to Western Electric Co., Inc.*

A device for tinning a strip, comprising a base, a container of molten metal on the base, a shaft rotatably mounted on the base and extending across the container, a collar rigidly secured to the shaft above the container for engaging and supporting a strip to be tinned, a pair of guide discs rigidly attached to the shaft on opposite sides of the collar for engaging opposite sides of and guiding the strip, a pair of applicator discs rigidly secured to the outer sides of the guide discs and extending radially beyond said guide discs into the molten metal in the container, and means for rotating the shaft and applicator discs in a predetermined direction.

Paint Stripper

U. S. Patent 2,937,111. *May* 17, 1960. *G. L. Leithauser, assignor to General Motors Corp.*

In a method of removing synthetic resin protective coatings the steps of immersing the work in a solution comprising by weight about 93.0 to 98.0 parts of a material selected from the group consisting of phenol and cresol, about 1.5 to 5.0 parts of orthophosphoric acid (85% solution by weight) and about 0.5 to 2.0 parts of a wetting agent, retaining the work in said solution for a time sufficient to loosen said coating, and removing said work.

Hot Tinning

U. S. Patent 2,935,962. *May* 10, 1960. *R. E. Deitrick and T. E. Moore, assignors to Western Electric Co., Inc.*

Apparatus for tinning terminals of an electrical component having terminals extending from opposite ends of a body portion thereof.

Conversion Coating — Aluminum

U. S. Patent 2,936,254. *May* 10, 1960. *N. J. Newhard, Jr. and D. Y. Dollman, assignors to Amchem Products, Inc.*

A bath for the coating of aluminum having a pH between 0.8 and 4.5 whose coating producing ingredients consists essentially of:

Ions of—	*Grams/liter*
Fluoride	0.15 to 12.5
Hexavalent chromium (expressed as CrO_3)	3.0 to 60
Phosphate (PO_4)	2.0 to 285

said bath being further characterized by containing a mixture of sodium and potassium in a total concentration of from 0.0026 to 0.0526 of a mol for every gram of fluorine present with potassium constituting from 10 to 90% thereof and also by containing dissolved aluminum to the point of equilibrium in the presence of the other essential ingredients whereby any precipitate which may be formed will consist essentially of K_2NaAlF_6.

Descaling Titanium

U. S. Patent 2,936,270. *May* 10, 1960. *H. G. Webster and R. P. Devane, assignors to Kolene Corp.*

The method of cleaning the surface of titanium metal comprising mounting the titanium metal in a work-holder in firm electro-conductive contact between the work-holder and the titanium metal body over a surface area ranging upward from a minimum of ½ to 2 units of area of contact between the work-holder and titanium metal surface for each 500 units of exposed titanium surface area, said work-holder being formed of electroconductive metal having an electrochemical activity less than that of the titanium, and immersing the combined work-holder and titanium metal mounted therein in a bath comprising predominantly molten caustic alkali maintained at a temperature in the range of 500 to 1300°F., for a period at least sufficient for initial reaction with the bath components.

Spray Gun

U. S. Patent 2,936,959. *May* 17, 1960. *E. T. Nord and S. R. Rosen, assignors to Bede Products Corp.*

A gun suitable for airless spraying of hot paint under high pressure.

Method of Tinning Steel Strip

U. S. Patent 2,937,108. *May* 17, 1960. *T. C. Toye, assignor to The British Iron & Steel Research Association*

A method of tinning a longitudinally travelling steel strip which comprises the steps of heating the strip to a temperature of approximately 900° C., cooling the strip by a reducing atmosphere constituted by a mixture of equal parts of hydrogen and nitrogen at a temperature of approximately 300°C. and simultaneously applying in the reducing atmosphere molten tin upon one surface of the strip across the entire width thereof by means of a first roller which has a metallic surface which forms a solid solution with the tin and which dips into a source of the molten tin and deposits the same on the strip.

Stripping Nickel Deposits

U. S. Patent 2,937,940. *May* 24, 1960. *M. Weisberg and F. P. Butler, assignors to Eltex Chemical Corp.*

A composition for selectively dissolving nickel, cobalt, and alloys thereof deposited on a basis metal, which composition consists essentially of an ingredient selected from each of the following groups, (*a*) and (*b*); (*a*) nitro-substituted aromatic compounds containing at least one NO_2 attached to a benzene ring which also carries a radical having a water-solubilizing effect on the nitro-substituted

aromatic compound and water soluble nitro-substituted aliphatic compounds and those which have a water solubilizing group attached thereto, and (*b*) primary and secondary amines, and tertiary amines having comparable alkalinity to said primary and secondary amines, the said composition being in the liquid phase, containing at least 0.01 per cent by weight of the combination of nitro-containing compound and amine, in a ratio of at least 1 part nitro-containing compound to 50 parts of the amine-containing compound and not exceeding 9 parts of nitro compound to 1 part amine.

Strip Cleaning Machine

U. S. Patent 2,936,278. *May* 10, 1960. *R. H. Shoemaker, J. A. Faler and T. J. Nolan, assignors to Kolene Corp.*

A molten salt bath apparatus for cleaning of metal strip by passing the same continuously through molten salt contained in the apparatus as an electrolysis bath under electrolyzing conditions for removal of oxides and scale thereon.

Bright Nickel

U. S. Patent 2,937,978. *May* 24, 1960. *W. Strauss, A. Kirstahler, W. Gundel and H. Hass, assignors to Dehydag, Deutsche Hydrierwerke G.m.b.H.*

As brightening agents, about 0.01 to 20 g. per liter of organic sulfonic acids having the general structural formula

$$X—R—SO_3H$$

and their water-soluble salts, wherein X is selected from the group consisting of halogen, cyanide and thiocyanide radicals, and R is an aliphatic radical with from 2 to 4 carbon atoms, and about 0.01 to 20 g. per liter of organic sulfonic acids having the general structural formula

$$Z—S—R—SO_3H$$

and their water-soluble salts, wherein Z is a radical comprising a carbon atom directly attached to two atoms selected from the group consisting of nitrogen, oxygen and sulfur atoms, said carbon atom also directly attached to the terminal sulfur atom of the $--S—R—SO_3H$ group, and R is a bivalent aliphatic radical with from 3 to 4 carbon atoms.

Electroless Copper

U. S. Patent 2,938,805. *May* 31, 1960. *M. C. Agens, assignor to General Electric Co.*

A solution for autocatalytically plating copper which is stabilized against self-decomposition, comprising an aqueous, alkaline solution of formaldehyde and a cupric ion which has been complexed so that the solution is free of cupric hydroxide, said solution containing a gas containing elemental oxygen.

Painting Method

U. S. Patent 2,938,810. *May* 31, 1960. *L. Porfilio and A. R. Luening, assignors to American Motors Corp.*

A method of painting an end product having adjoining surfaces, the first of which is disposed so that liquid paint applied thereto in an excessive quantity will not adequately drain therefrom by gravity and the second of which is disposed for adequate drainage by gravity, such method including the steps of: applying liquid paint to both surfaces in excessive quantities; moving a squeegee over the first surface so that the excess paint on the first surface is flowed onto the second surface; adding an additional quantity of liquid paint into the flowage of excess paint immediately after it is squeegeed onto the second surface; then permitting the excess paint on the second surface to drain therefrom.

Cadmium Bath

U. S. Patent 2,938,840. *May* 31, 1960. *S. W. Strauss and P. N. Vlannes.*

In the electrodeposition of cadmium, the improvement which comprises electrodepositing cadmium from a liquid bath comprising a solution of cadmium acetate and methanol at a temperature in the range of from about —70°C. to about 20°C.

Plating Rack

U. S. Patent 2,938,850. *May* 31, 1960. *H. A. Nali, assignor to William E. Collins.*

A work holder for a plating bath comprising an elongated substantially vertical frame having a suspension hook on the upper end and having upwardly directed work supporting hooks in laterally spaced relation on the lower end, a yoke mounted on said frame transversely thereof in longitudinally spaced relation to said work supporting hooks, said yoke having hook means provided thereon for engagement with the work to retain it in supported position for plating, the yoke being generally U-shaped and being pivotally mounted on the frame by means of the cross-portion of the U to swing from a position in which the hook means is in retracted relationship to the work to another position in which the hook means is engageable with the work, and spring means yieldingly engaging the cross-portion of the U for releasably holding said yoke in retracted position.

Cleaning Ferrous Metals

U. S. Patent 2,939,826. *June* 7, 1960. *G. L. Gulick.*

In a method of cleaning a ferrous metal object, the steps which comprise immersing said object in an aqueous solution consisting essentially of .3-30% alkali metal hydroxide and about .5-47% by weight of a tertiary amino alcohol having nitrogen bonded directly to terminal carbon atoms of three saturated hydrocarbon chains which each have a single OH group bonded to a carbon atom other than that bonded to the nitrogen and where said chains contain from two to four carbon atoms, and subjecting said solution and the object immersed therein to a high frequency induction field by passing alternating current of at least 400 cycles per second through said solution and object.

Immersion Tin Bath

U. S. Patent 2,940,867. *June* 14, 1960. *M. A. Streicher, assignor to E. I. du Pont de Nemours and Co.*

In a process for depositing tin on a selected area of a steel sheet the steps comprising mechanically roughening such area and applying thereto an aqueous bath consisting essentially of the following proportions of:

	g./l.
Stannous sulfate	10- 40
Sodium bisulfate	100-250
Unsubstituted polyethylene oxide having a moleculer weight of about 6.000	30-100

Electroplating System

U. S. Patent 2,939,828. *June* 7, 1960. *J. K. Hausner, assignor to Karl K. Kaempfer.*

In an electroplating system in which

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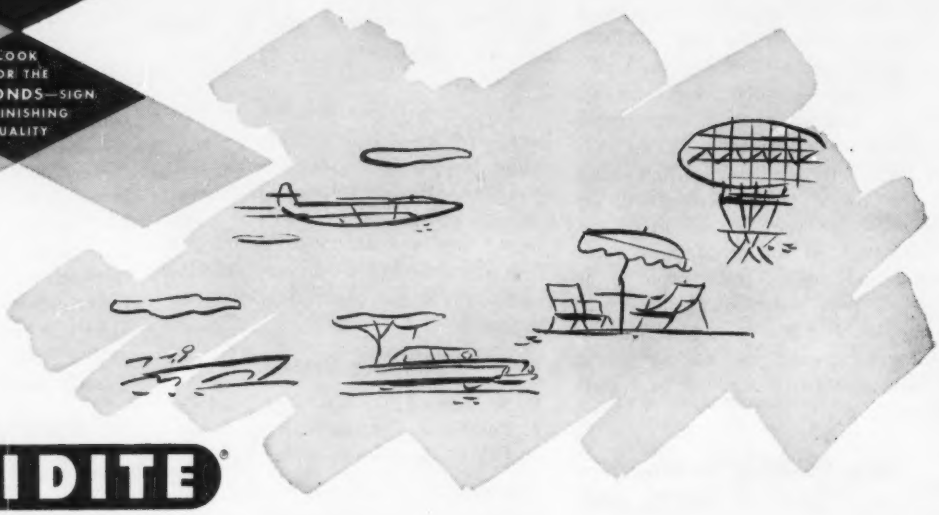

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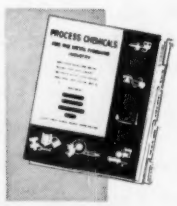

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Printed Circuits

U. S. Patent 2,940,018. *June* 7, 1960. *W. G. Lee, assignor to General American Transportation Corp.*

A printed electric circuit comprising an insulating base, and a composite electric circuit element carried by the surface of said base and including inner and outer electrically conducting metal layers disposed in metal-to-metal contact with each other, said inner layer being directly and intimately adhered to the surface of said base and consisting essentially of a nickel-phosphorus alloy, said alloy containing by weight about 89% to 95% nickel and about 5% to 11% phosphorus, said outer layer being directly and intimately adhered to said inner layer and consisting essentially of copper.

Vacuum Deposition

U. S. Patent 2,940,873. *June* 14, 1960. *M. F. Toohig, assignor to International Telephone and Telegraph Corp.*

The method of increasing the thickness of a flat metal screen having a mesh finer than 300 and being formed in a spherical configuration without substantial filling of the apertures therein comprising the steps of: positioning a receptacle in a container, placing a quantity of metal in said receptacle, positioning the screen in said container spaced above a point in said receptacle with said point being located at the center of curvature of said screen; evacuating said container; heating said receptacle to a temperature sufficient to melt and boil said metal therein whereby the vapor formed by said boiling emanates from said point and is deposited on the surface of said screen; and continuing

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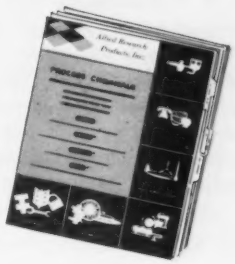
Line for Metal Finishing

PROCESSES AND PRODUCTS FOR CORROSION PROTECTION, PAINT BASE, DECORATIVE FINISHING

A complete line including IRIDITE Chromate Conversion Coatings for non-ferrous metals, IRILAC Clear Protective Coatings for all metals, ISOBRITE Chemically Different Plating Brighteners and ARP Process Chemicals.

If one of our present products does not meet your needs, we'll be glad to work with you to find an answer to your problem.



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Includes information on WAGNER Silicon and Selenium Rectifiers, WAGNER Auto-Loaders for transfer of racks and parts from conveyors to plating machines or between conveyors, Automatic and Semi-Automatic Plating Machines, Barrels, Tanks and other equipment.

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Ask about our Subscription Plan which combines your new nickel purchases with a service to recast your butts and spears, resulting in substantial savings.

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West Coast Licensee for Process Chemicals: I. N. Butcher Co.
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Chemical and Electrochemical Processes, Anodes, Rectifiers, Equipment and Supplies for Metal Finishing

IRIDITE® Chromates | IRILAC® Coatings | ISOBRITE® Brighteners | ARP® Supplies | WAGNER Equipment

said heating until the thickness of said screen is substantially increased.

Vitreous Enameling

U. S. Patent 2,940,865. *June* 14, 1960. *J. D. Sullivan, assignor to A. O. Smith Corp.*

A method of vitreous enamel coating a ferrous material, which comprises cleaning the ferrous material, applying a layer of discrete fine particles of NiO directly to the cleaned material, applying a vitreous enamel frit to the ferrous material over the layer of NiO particles, and firing the material at an elevated temperature to fuse the vitreous enamel to the ferrous material, said layer of NiO particles providing a substantial amount of surface area reacting with the hydrogen developed during firing to prevent fishscaling and promote adhesion of said vitreous enamel to the ferrous material.

Hot Galvanizing

U. S. Patent 2,940,870. *June* 14, 1960. *A. T. Baldwin, assignor to Hanson-Van Winkle-Munning Co.*

The method of galvanizing a ferrous metal article which comprises wetting the article with an aqueous ammoniacal zinc chloride solution, drying the article, introducing the dried article into a bath of molten zinc through a molten salt blanket floating thereon, said salt blanket being composed predominantly of 40% to 80% by weight of zinc chloride and 15% to 45% by weight of potassium chloride, said salt blanket having a melting point below 700°F. and being and remaining substantially free of ammonia, and withdrawing the article with a thin adherent coating of zinc from the zinc bath.

Plating Surgical Needles

U. S. Patent 2,941,501. *June* 21, 1960. *R. C. Bell, assignor to American Cyanamid Co.*

An apparatus for plating surgical needles.

Plating Barrel

U. S. Patent 2,941,656. *June* 21, 1960. *W. H. Jackson, assignor to The Udylite Corp.*

In material handling apparatus which includes a rotatable material container movable along a predetermined path and provided with an opening through which material is loaded into the container and unloaded from the container, a door panel movably mounted on said container for movement between an open position entirely to one side of said opening during loading and unloading of the container and a closed position extending across the opening during movement along said path, and co-acting releasable latch means on said panel and said container for releasably maintaining the panel in said open and closed positions.

FOREIGN LITERATURE

Investigation of the Physico-Chemical Characteristics of Electrolytic Coatings

A. T. Wagramian: *Korrozios Napok* (Hungary), **58,** No. 124, 662.

The author conducted investigations mainly on the internal stresses which occur with nickel and copper coatings in the presence of addition materials in the bath. This work established that the internal stresses are dependent on the transition of the characteristics of the metal being electrodeposited, on the conditions of metal deposition, on the nature and composition of the addition agents present, and on the concentration of the addition agents.

It was found that it is possible to establish a relationship between the internal stresses of the electroplated coating and its porosity, as well as between the internal stresses and the overvoltage. The fundamental causes which can give rise to internal stresses, can be as follows:

1. Change of the parameter of the crystal lattice;
2. Change in the spacing distances between the crystals of the metals deposited;
3. Growth and change of the crystals of the metals deposited;
4. Chemical combination between the metal and the impurities occluded in the coating.

Application of Gaseous Chromizing for Woodworking Machine Tools

Galvano (Paris), **28,** No. 268, 238.

The small dimensions of the segments of chain saws for cutting wood do not allow of treating the metal by the normal hardening methods. Development work was conducted to treat the parts by means of hard chrome plating, but this procedure had to be abandoned because of the tendency of the chromium to lift in use. A new method of treatment was then tried, consisting of chrome coating the segments by means of a gaseous diffusion process.

The chain saw tooth segments measure 30 x 30 x 1.2 mm. and are placed in several separate layers in a cylindrical vessel filled with a powder of the following composition:

Chromium metal	50%
Alumina	45%
Ammonium chloride	5%

To avoid decarburization of the metal, a coating of wood charcoal is placed between the two end covers. This container is then heated in an electric furnace to 1,000-1,100°C. The thickness of the coating is a function of the composition of the steel and increases with the duration of the operation. After 10 hours treatment, the coating thickness amounts to between 30 and 80 microns. The metal coating obtained is mirror bright.

After having been coated in this manner, the saw tooth segments are annealed at 760°C., a quench at 840°C. in oil, and tempering at 410°C. which serves to give a surface hardness of Rc = 40.

Metallographic examination of the coating has shown that, immediately below the chromium film, there is a thin coating with a higher carbon content than that in the core of the segment.

The optimum thickness of the chromized coating is of the order of 10 to 15 microns.

Japanese Practice with Electropolishing of Stainless Steels

S. Tajima: *Metalloberflaeche,* **14,** No. 8, 251-252.

Electropolishing of stainless steels is being conducted on a large scale in Japan together with the electropolishing of aluminum and aluminum alloys. In the opinion of the author, the following points are of particular technical importance, although practice is similar to that in Europe and the U. S. A.

1. The polishing effect obtained with the stainless steels is determined dominantly by the grain structure of the metal. The austenitic 18/8 stainless

steels are the most easily polished and give the best effect. However, the polishing effects are good with the ferritic or sorbitic types of stainless steel.

2. As these steels are rust-resistant, they are not attacked by the adhering electropolishing electrolyte when taken out of the bath. They can remain for a long time in the rinse water; since immediate drying is not necessary. In comparison to processing carbon steels, the after-treatment is very simple.

3. Generally speaking, these processes cannot be employed for precision machine parts.

Electropolishing improves the corrosion resistance of the stainless steels. According to investigations conducted by Yamaguchi at the Physico-Chemico Research Institute, Tokyo, using the electron-diffraction method, in electropolishing stainless steel, the iron is preferentially dissolved out. These investigations were carried out on an 18/8 austenitic chrome-nickel steel and on a 13% chrome steel. Through this selective solution, nickel-chrome oxides are formed on the surface of the austenitic steel and iron-chrome oxides on the surface of the chromium steel. These increase the corrosion resistance. In the opinion of the author, the following factors also enter into consideration:

1. The cold-formed surface coating produced by mechanical forming processes is removed by the electropolishing treatment.

2. No fouling of the surface is caused by substances pressed-in during polishing or buffing.

3. In the manner described above, a new, passive alloy coating is formed by selective anodic corrosion during the electropolishing treatment of the iron and by simultaneous anodic oxidation. The actual surface characteristic is improved by the smoothing-down of the unevenesses in the microscopic range.

4. Simultaneously, the absorption or adhesion of corrosive-acting substances is reduced.

For all types of stainless steels it has been found that the sulfuric-phosphoric-chromic acid solutions give the best results. Obviously, sulfuric-phosphoric acid baths are also suitable. The addition of chromic acid, however, minimizes the hazing effect often observed. In addition, the simple sulfuric-phosphoric electrolytes in many cases give poor results with the heat-resisting chromium-silicon steels, while the chromic acid electrolytes give outstanding results, even here.

With sulfuric acid alone in the bath, only the 18-8 class of stainless steels can be electropolished or, perhaps, the higher-alloyed austenitic steels at a higher temperature. On the other hand, phosphoric acid-electropolishes not only the 18-8 steels but also the austenitic chromium-manganese steels and, in addition, the ferritic 18% chromium steels. In the case of chromium steels with 13% chromium, none of these acids is suitable alone — it is necessary to work with a combination. These hardening steels are particularly difficult to electropolish in the tempered condition, in which they are used practically exclusively. Because of the relatively high expense of the phosphoric acid used in the baths (5 times that of sulfuric) and because phosphoric acid must be used with these steels, the aim in Japan is to reduce the amount to a minimum by the adoption of suitable measures.

Japanese Experience with Electropolishing of Aluminum and Aluminum Alloys

S. Tajima: *Metalloberflaeche*, **14**, No. 6, 179-180.

Electrolytic and chemical polishing of aluminum and alloys is employed on a large industrial scale in Japan, in conjunction with anodizing treatments. The processes for polishing aluminum reflectors have been developed in the main, by the aluminum manufacturers. Illuminite process (developed by the Nasu Aluminum Co., Tokyo and using phosphoric acid) is stated by the author to be the first electropolishing process for aluminum using phosphoric acid as the electrolyte. This process operates as follows:

1st. stage. 99.8% aluminum is treated anodically in 50% phosphoric acid, using a graphite cathode at 60°C. and a current density of 40 amp./dm.^{2}. The processing time given is 2 minutes.

2nd. stage. The electropolished aluminum is anodized with a lead cathode, in 10% sulfuric acid, at a current density of 1 amp./dm.^{2}. The processing time is 5 to 10 minutes.

In order to obtain uniformly good, mirror-bright surfaces, the iron content in the aluminum should not be higher than 0.09% and the silicon content not higher than 0.07%. If more iron is present, then the only remaining possibility is a heat-treatment with subsequent quenching. Greater amounts of these two elements give a network pattern after anodic polishing. This becomes unpleasantly noticeable with the subsequent anodizing, on account of the clouding of the oxide coating. Aluminum of this high degree of purity is very soft. Accordingly, with parts which are mechanically stressed, one alloys with a maximum of about 1% magnesium. The reflectivity and transparency of the oxide film do not suffer.

The influence of other impurities in the metal, on the polishing results can be summarized as follows:

1. Inclusions of small amounts of titanium, chromium, magnesium and zinc have no effect on the reflectivity;

2. Present in larger amounts, magnesium reduces the reflectivity considerably;

3. Cadmium is a more harmful impurity than zinc; present in greater amounts, both elements reduce the reflective capacity considerably.

4. Any clouding of the oxide coating occurring with the subsequent anodizing is, in the main, to be ascribed to iron and silicon.

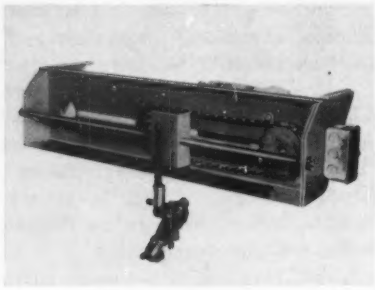
These two elements are of decisive influence on the polishing and anodizing result.

In this connection, it should be pointed out that titanium and chromium give a grain-refining effect. Greater additions of these elements, however, have a harmful effect on the reflectivity. The alloy with 0.5% magnesium is very frequently employed in Japan.

A sealing treatment in steam is generally given. This steam-sealing treatment, developed in 1928 by Setoh and Miyata in Japan, has an outstanding place among modern sealing processes. An extremely high corrosion and discoloration resistance is obtained, particularly with anodized films produced in the oxalic acid bath. With this treatment, the parts are processed for about 20 to 30 minutes in an autoclave with a steam pressure of 3 to 5 atmospheres. A slight recession of the reflective capacity after anodizing and sealing is unavoidable; accordingly, a light wheel polish is given. The actual reflectivity obtained in production are as follows: After electropolishing 93.1%; after anodizing this dropped to 89.6% and, after the steam-sealing, to 81.2%. This was brought back to 86.8% with the light wheel polish mentioned.

Liquid Composition Applicator

Metal Finishing Dept., Frederic B. Stevens, Inc., Dept. MF, 1800 18th St., Detroit 16, Mich.



A new automatic applicator of liquid buffing and polishing compositions, the Travelling Gun Mover is designed for use with wide buffs where the application of a uniform spray of liquid compound is a problem.

The gun mover is designed to improve liquid compound adhesion, which will result in cleaner, faster and more economical buffing and polishing operations.

The device is a simple, maintenance-free mechanism featuring a power drive chain and sprocket device. It permits a wide variation in width of travel and can be used with single or multiple buffing systems.

Barrel Finishing Compounds

Allied Research Products, Inc., Dept. MF, 4004 E. Monument St., Baltimore 5, Md.

A wide variety of barrel finishing compounds is available for finishing practically any type of metal or plastic part. The materials from which the compounds are made include oxide chips, ceramic shapes, granite chips, limestone chips, natural stone and steel balls.

Immersion Rhodium Bath

Technic, Inc., Dept. MF, P. O. Box 965, Providence, R. I.

An immersion (electroless) rhodium plating bath which is expected to find wide application in the electronics industry is a moderate-priced stable solution which will deposit a tight-grained, pore-free deposit of rhodium on copper or nickel. It is claimed that a five-minute deposit over copper will withstand a 30-minute immersion in a 50 per cent nitric acid solution.

Plating Barrels

Imperial Industries, Inc., Dept. MF, 4436 Walker Ave., Wayne, Mich.

An advanced, new plating barrel design that results in up to 48% greater plating efficiency utilizes an exclusive "fin" design for automatic plating barrels in a wide range of sizes, materials, and models.

The oblique barrel is made in polypropylene and Copolefin, a special olefin copolymer. Features of the barrels, which are 100% interchangeable with standard barrels on automatic plating machines, include: sturdy, all-welded and reinforced construction; great resistance to chemicals, stress, impact, abrasion, and heat; long service life; light weight; and low cost. They stand up under all solutions and temperatures normally encountered in the plating process. Barrels come complete with bail.

The units are also available in high-temperature acrylic and other materials, on special order. In addition to standard sizes and perforations, special barrels will be custom-fabricated to customer specifications.

Burnishing Compound

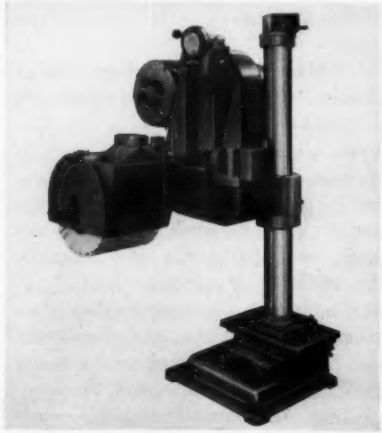
Oakite Products, Inc., Dept. MF, 118 Rector St., New York 6, N. Y.

A new product, designed for burnishing zinc, aluminum, steel and other metals, Oakite FM 286, works well on all metals except magnesium and offers many advantages not found in similar materials. Unlike most other burnishing compounds, it is mildly acidic, and produces brilliant blue-white color on zinc die-castings. It often eliminates the need for the bright dip operation on metals which develop oxide films, it is claimed. Since it contains no soap, it will not leave a film to hinder plating. It has greater hard-water tolerance than comparable materials.

Polishing Heads

Hammond Machinery Builders, Inc., Dept. MF, 1601 Douglas Ave., Kalamazoo, Mich.

New variable speed automatic polish-



NEED HEAVY BUILDUP FOR RESIZING, ELECTROPLATING, ELECTROFORMING OR OTHER FUNCTIONAL USES? EXPERTS AND USERS AGREE: NICKEL SULFAMATE IS THE MOST SUITABLE BATH FOR FUNCTIONAL NICKEL PLATING.

NICKEL SULFAMATE
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NICKEL SULFAMATE

MECHANICAL PROPERTIES OF DEPOSITS ARE CONTROLLABLE

CONCENTRATE CHLORIDE FREE

NO DRY CHEMICALS TO DISSOLVE

EASY TO CONTROL

NICKEL SULFAMATE

ASK H-VW-M, *NATURALLY*

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Progress in metalfinishing through advanced processes • equipment

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2080

ing and buffing heads utilize the dial control feature, with which proper wheel size can be selected while the head is running. Various speed ranges are available.

Variable speed automatic polishing and buffing heads provide numerous advantages: 1. Wheel economy — as wheels wear speed is increased, giving maximum production and wheel life. 2. Increased production—the most efficient speed can be selected without stopping the head. 3. Better finish — different materials require the different speeds readily available with this feature. 4. Convenience — metal chart on the dial control indicates the right speed for each job.

Glass-Reinforced Polyester Tanks

Justin Enterprises, Inc., Dept. MF, 7000 Montgomery Pike, Cincinnati 36, Ohio.

A new line of vertical or horizontal heavy-duty glass reinforced polyester tanks is available in a number of capacities ranging from 20 to 20,000 gal. Many of these capacities are produced as stock items made from standard parts. A significant decrease in the cost of the units, faster delivery, and closer quality control are said to be the advantages of standard production.

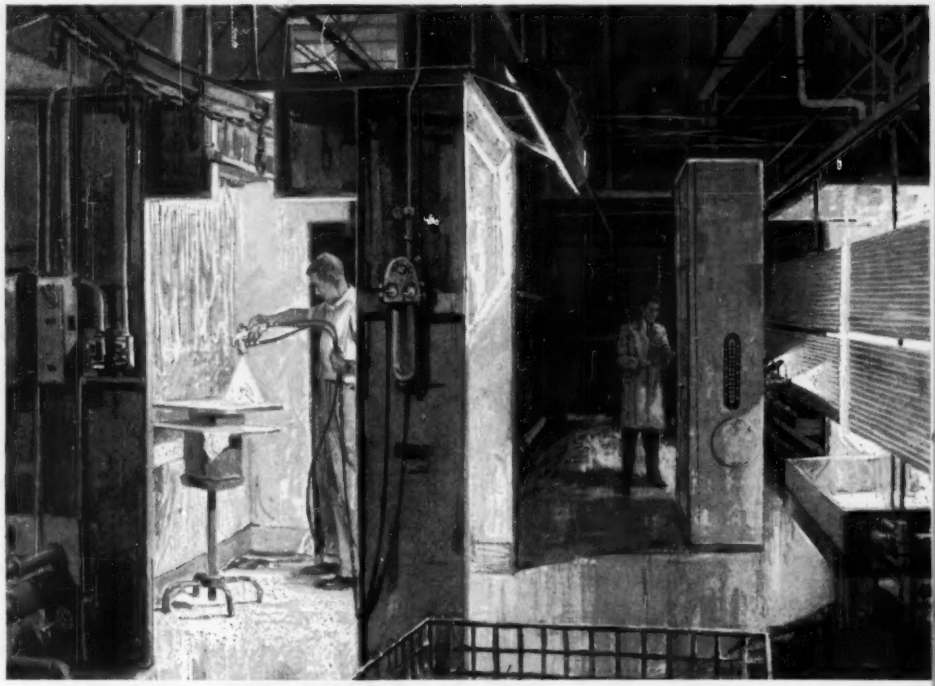
The tanks have been fabricated from a specialty bisphenol-A polyester resin reinforced with glass fibers, which is slated to be more resistant to prolonged contact with most acids, alkalies, and bleaches at elevated temperatures than general-purpose or other polyesters.

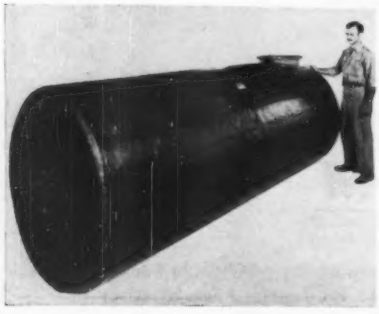
Spray, dip, or flow coating . . .

DeVilbiss total

can help determine the best method for you

You get an unbiased recommendation from DeVilbiss—the only company that manufactures a complete line of coating equipment, from spray guns to engineered finishing systems. Trained engineers provide total service from initial planning to operator training. Our customer research laboratory will run comparison tests of your products for results that reveal what method is best for you. Or our engineers will suggest ways to make your present system more efficient with minimum changes. Let DeVilbiss total service help you. The DeVilbiss Company, Toledo 1, Ohio. Also Barrie, Ontario; London, England; São Paulo, Brazil. Offices in principal cities.





The use of a two-step operation in fabricating the tanks insures a high strength-to-weight ratio as well as extreme corrosion resistance. The first step involves the application of an all-important chemical-resistant "barrier coat" of bisphenol-A polyester as the inner surface of the tank. In the second fabrication step, build-up of the main body of the tank, a special process is used to achieve a high glass content for strength, durability, and impact resistance.

Ready observation of the liquid level within the tank is made possible by the translucence of the structure. The 1,000-gallon tank weighs approximately 350 lbs., compared with 1,800 lbs. for a comparable tank made from stainless steel. Mounts, also fabricated from reinforced plastic, are located according to the user's specifications.

service

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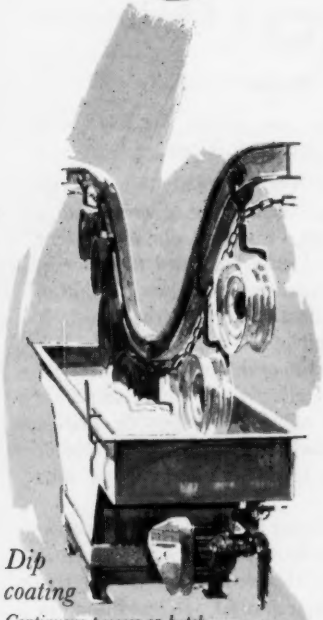
DEVILBISS



Dip coating

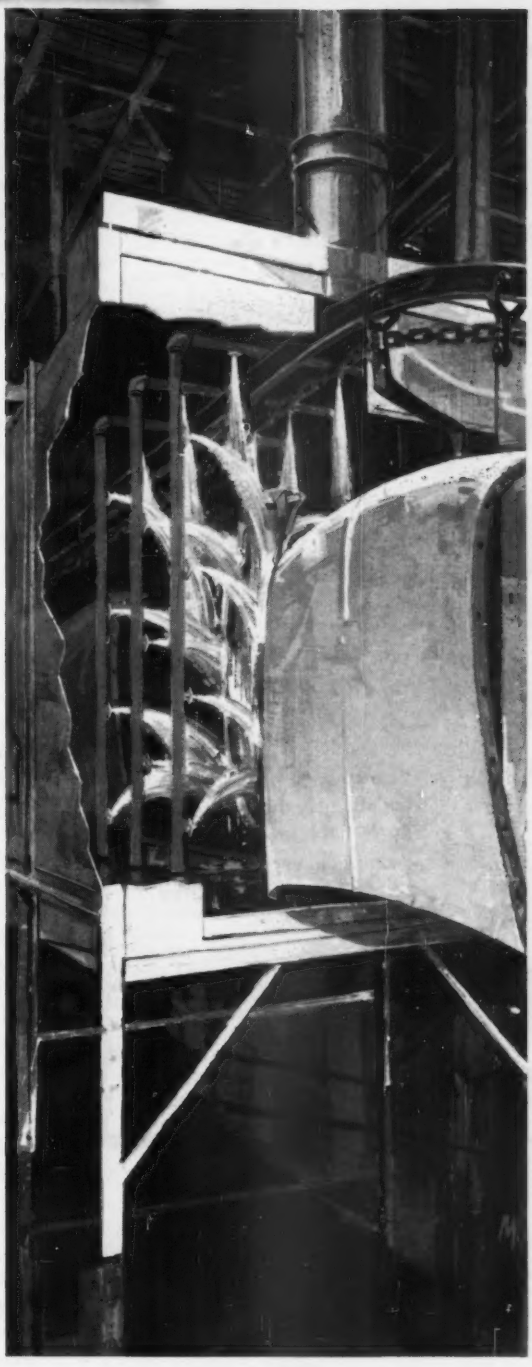
Continuous process or batch type, with scientific vapor and viscosity controls to ensure uniform finishes

Flow coating

Saves man power, floor space in prime- or single-coat applications

Spray coating

DeVilbiss manual and automatic equipment efficiently coats products of any size or shape



vantages, this newest development is low priced to combine the maximum in zinc base cleaning with minimum operating cost.

Neoprene Leak Sealer

Gates Engineering Co., Dept. MF, Wilmington 99, Del.

The problem of repairing pickling tank leaks quickly and economically without draining off the pickling liquor has been solved by several large steel companies. The simple low cost system employed consists of pumping Gaco Neoprene Troweling Compound directly through the opening in the steel tank, after which the material courses through the leak and cures to a plug, closing the leak quickly and effectively.

The only equipment required for the operation is an Alemite grease gun. The gun cylinder is bathed with N-450-2 Putty Vehicle; the N-250-1 Troweling Compound, accelerated with N-300-4 Accelerator, is packed into the gun cylinder, and the nozzle of the gun is inserted through the hole in the tank where the leak has occurred. The compound is then pumped through the opening until no more of the material can be forced into the hole. Thereafter, the compound cures to a solid neoprene plug, closing the leak and lasting indefinitely.

Gas-Fired Infra-Red Burner

Bryant Industrial Prods. Corp., Dept. MF, 17700 Miles Ave., Cleveland 28, Ohio.

A gas-fired infra-red burner designed specifically for low-temperature industrial proc-

Optional fittings include a manhole, complete with cover and cadmium-plated lugs, and stainless steel or reinforced plastic fittings of any type located according to the customer's instructions.

Electrocleaner for Die Castings

Frederick Gumm Chem. Co., Inc., Dept. MF, 538 Forest St., Kearny, N. J.

Clepo 50-ZB is stated to be a unique development for use in cleaning and conditioning zinc die castings. It combines excellent cleaning properties, with the ultimate in surface conditioning to provide maximum adhesion of plated coatings. In addition, the surfaces of polished die castings are not darkened or discolored and, as a result, the overall appearance of the final plate is improved.

In addition to these operating ad-

Once you use it you'll Order... Again... and Again... and Again!

Every can filled with a full weight of extra high quality 99.75+% Chromic Acid. Prompt delivery made from ample factory and nearby distributor stocks.

BETTER FINISHES & COATINGS, INC.
268 Doremus Avenue, Newark 5, N. J. · 2014 East 13th St., Los Angeles 21, Calif.

essing applications offers optimum heat-transfer efficiency (maximum radiation intensity at minimum fuel input) as a characteristic of the patented burner design.

Face temperature of the 4 x 18 inch burner screen is 1200 to 1800°F. Nominal heat output is 30,000 B.t.u. per hour per unit; each unit has a built-in flame adjustment — the first adjustable infra-red burner available. Heat pattern across an entire process assembly can be profiled or contoured to meet any demand.

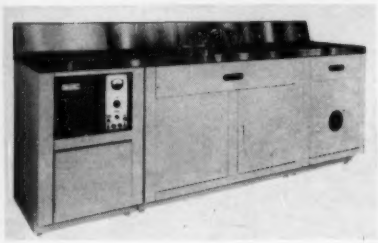
The new units employ all-metal crackproof Inconel radiant screens for peak heat release and longest service life. The one-piece screens are removable for easy maintenance. Burners have cast-iron integral manifolds, finned for aircooling to eliminate flashback, which can be assembled into continuous lines up to 100 feet long. Burners light end-to-end full length from a single pilot, and will also light from one line to an adjacent one when assembled in solid banks.

The patented gas-fired infra-red burner unit utilizes standard industrial mixers, pressure regulators, and pilots.

Ultrasonic Cleaning Units

Circo Corp., Dept. MF, 51 Terminal Ave., Clark, N. J.

Ranging in tank size from 2 to 20 gallons, the new Circosonic "white room" cleaners are compact, completely self-contained systems, complete with hot and cold water wash and rinse, re-circulating pump, filter, and temperature control. They also can be equipped with a dryer and a high pressure air blow-off for applications requiring them.



Nickel Stripper

Enthone, Inc., Dept. MF, 442 Elm St., New Haven 8, Conn.

Enstrip S-60, a ready-to-use stripper for nickel and other metals, is a free-flowing, readily soluble powder which need only be added to water at room temperature to make a solution which will strip nickel from steel. It contains all of the ingredients, including sodium cyanide, which are required for effective stripping. Separate additions of cyanide eggs or bricks, which dissolve slowly, are eliminated. A saving in time and labor is thus realized.

The stripper is used at a concentration of 20 oz./gal. The nickel plate is chemically dissolved, and no electric current is required. In addition to nickel, it also strips copper, brass, cadmium, zinc and silver from steel, most iron alloys and magnesium without attack of the basis metal.

Stripping is usually performed at room temperature in which case the work can be allowed to remain in the stripping tank overnight. Although the work soaks for several hours after stripping is complete, there is no attack on most steel alloys. For faster stripping, temperatures as high as 170°F. may be used. Nickel is removed at a rate of 0.002" per hour at 140-170°F., and brass at a rate of 0.003" per hour at 140-150°F. Plain steel tanks or drums are suitable for holding the stripping solution.

Blast Cleaning Abrasive

Pangborn Corp., Dept. MF, Hagerstown, Md.

A completely new blast cleaning

abrasive is designed to occupy a position between present malleable abrasives and steel both from the standpoint of performance and initial cost.

Pangborn G is reported to last up to 2½ times longer than malleable abrasives, although not as long as premium grade steel shot. Speed of cleaning is faster than the lower hardness malleables, the same as the harder malleable abrasives but less than steel of higher hardness.

Infra-Red Catalytic Heating Panels

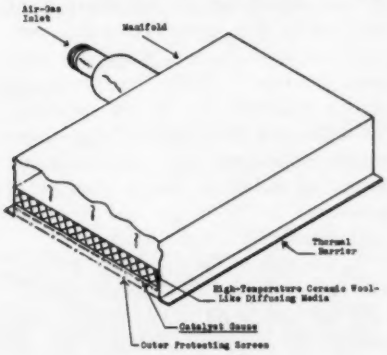
Catalytic Combustion Corp., Dept. MF, Detroit 8, Mich.

A mixture of air and fuel gas is supplied through an enclosed manifold. The mixture passes through a high-temperature ceramic wool-like diffusing media, and thence through a catalytically active metal gauze, where flameless combustion of the fuel occurs.

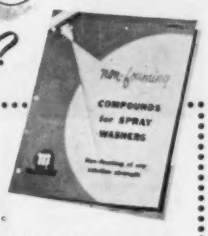
The diffusing media performs two functions. The first is to provide a slight resistance, or back pressure, needed to attain good velocity distribution of the fuel mixture at low flow rates. The second is to insulate against, and pick up, backward radiation from the gauze, and at the same time to pre-heat the fuel mixture passing through the media, thus maintaining catalytic combustion on the gauze surface.

Unlike other types of gas-fired infra-red burners or heaters, these units operate below the flammable range. Further, there is a direct conversion from gaseous fuel energy to infra-red energy directly on the surface of the gauze at the point of combustion. The heated gauze then acts as the source of radiant energy for heating adjacent work or product.

The infra-red unit is designed to provide heat release ranging from 2,000 to well over 10,000 Btu/hr/square foot of emission surface. This heat release is the equivalent of from 4 to above 20 watts/in^2.



Slight Problem with Foaming?



You'll find your answer in this new trio of *non-foaming spray washing compounds* — designed to out-perform any other cleaners on the market, yet guaranteed non-foaming at *any* solution strength.

Featuring a radically different *non-foaming* surfactant, these new Magnus compounds eliminate all restrictions on solution strength, simplify "make-ups" and insure both *unmatched cleaning and free-rinsing.*

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for Aluminum and Light Duty Cleaning.
MAGNUS 92X3
for Brass, Copper, Steel and Certain Alloys.
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for Heavy Duty Cleaning of Steel.

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☐ Please have service representative call to survey our cleaning problems.

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EQUIPMENT • CHEMICALS • METHODS

Zincate for Aluminum

Diversey Corp., Dept. MF, 1820 W. Roscoe St., Chicago 13, Ill.

A new zincate immersion compound for coating aluminum work with a tightly bonded film of metallic zinc before electroplating with other metals, ZN-77 provides for lower use concentrations, faster drainage of solution from processed parts, reduced drag-out losses and greater tolerance to temperature variations, it is claimed.

The compound is a rapidly soluble, free-flowing granular material, which does not cake under normal storage conditions.

Abrasive Belt Head with Resilient Driven Back-Up Belt

Murray-Way Corp., P. O. Box 180, Birmingham, Mich.

The abrasive belt on this machine travels on a resilient driven back-up belt, which is supported at work position by a steel platen. This back-up belt, constructed of sturdy rubber and fabric, saves wear-and-tear on the abrasive belt by providing resilience for the cutting grain, and by giving it a moving support as it crosses the steel platen at work position.

This photograph shows the abrasive belt head with safety hood cover removed. The large table-top may be used horizontally, or tilted to produce a

ARMORETTE COATING USED BY BECKMAN INSTRUMENTS ON COMPUTERS, TEST EQUIPMENT

BECKMAN
ELECTRONIC COUNTER

A textured vinyl finish applied at low baking temperatures, ARMORETTE is used on a number of Beckman's computers and electronic test instruments. Another leading ARMORETTE application: garnish moldings of the Chrysler Imperial

ARMORETTE offers you these important advantages:

- A wide range of textured vinyl finishes ranging from those resembling alligator to finishes similar to laminated vinyl.
- Low baking temperature. ARMORETTE can be baked at temperatures as low as 160°F and has been applied successfully to such non-heat-resistant materials as polyester, wood and chipboard.
- Three times more abrasion resistant than gloss or semi-gloss enamels and of comparable cost.
- Can be used on a broad range of dissimilar materials including steel, aluminum, wood, reinforced polyester and pressed wood.
- Remarkable ability to cover surface imperfections.
- A wide selection of gloss and colors, including both metallic and non-metallic.
- Excellent salt spray, humidity, chemical and scuff resistance.

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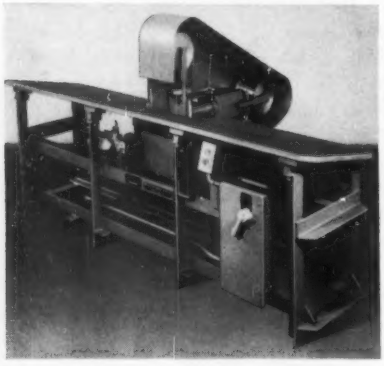
ARMORETTE

John L. Armitage & Co.

SYNTHETIC ENAMELS • VINYLS • VARNISHES • LACQUERS
245 Thomas Street • Newark, New Jersey

chamfer or beveled edge on the work. In addition, it may be positioned so as to provide an angular surface in relation to a second surface.



Standard abrasive belts may be used with this new machine, and belts are easily removed and replaced when necessary. Size of work table varies with work specifications.

Compact Degreaser

Manpro Corp., Dept. MF, 1402 Hilton Road, Detroit 20, Mich.

The Vibra-Bantam is a new, small, low cost subsonic degreaser, which features high production automatic in-line cleaning for all small parts. The Vibra principal utilizes a unique vibrating spiral elevator to move the work rapidly through non-flammable cleaning solvents and vapors, thereby eliminating tote pans and baskets.

The unit is extremely compact, 20 inches square with a 42 inch overall height, yet it will process the full capacity of any screw machine, cold header or punch press. Chips are automatically separated and clean dry parts continuously emerge ready for inspection. The degreaser is available with either steam or electric heat.

Plastic Scoop

Gracox Inc., Dept. MF, 162 Colgate Ave., Buffalo 20, N. Y.

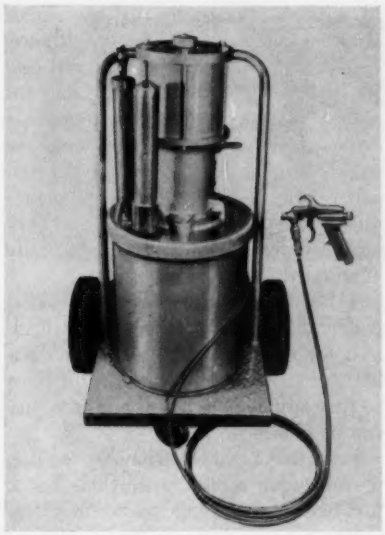
A new design plastic 2-quart scoop has the handle near the center of gravity so that the weight is balanced. It is made of a special polyethylene, a strong, clean, durable plastic which is not affected by the common foods, grains or chemicals.

Airless Spray Painting

Spee-Flo Co., Dept. MF, 6614 Harrisburg, Houston 11, Tex.

The HydraAirless 30 system for airless spray painting is designed to take full advantage of the total atomization H-Gun introduced by the above company early this year. The system features the new Atlas II pump, the first high pressure reciprocating pump designed expressly for airless spraying. This divorced construction, long stroke pump is powered by a 5½-inch air motor of balanced design. Operating pressures to 3000 psi are available with this 30 to 1 ratio pump.

In addition to the high ratio feature, the unit offers 40% greater volume and will handle up to four guns, either manual or automatic. Heated or un-



heated, fixed or portable, the machine is available in 10 gallon and 55 gallon sizes, and also as a standpipe unit for circulating systems.

Corrosion Preventive

Corrosion Reaction Consultants, Dept. MF, 116 Chestnut St., Philadelphia 6, Pa.

A new, effective, low cost, long term protective coating, known as Soft-Seal, is being used to prevent corrosion of metals in production processess, storage and shipment. It penetrates grain boundaries, cracks and pores to form a continuous protective film from 1 to 8 microns thick. This product eliminates the use of tenacious coatings and is applied by spray or immersion.

The material is equally effective on iron, steel, aluminum, magnesium and plated finishes, and many other surfaces. The length of time it remains effective varies with the conditions of exposure. It may last less than a year or more than 5 years. It never becomes dry, hard or brittle. It is harmless to painted surfaces and is easily removed with live steam or solvents.

The product is packaged in 16 oz. aerosol cans; 1, 5 and 55 gallon containers.

Spray Nozzle

Delavan Mfg. Co., Dept. MF, West Des Moines, Iowa.

The new Type F nozzle is recommended for a wide variety of washing, cleaning and flooding applications where flat low impact spray patterns are required. The nozzle is furnished in a full range of capacities and spray angles and is offered in both brass and stainless steel. All surfaces are accurately machined and the nozzle has no vanes, cores or other internal obstructions.

Hammond OF KALAMAZOO

"GOOD MACHINERY SINCE '82"

Hammond MODERN SELF-CONTAINED GRINDER-POLISHER-DUSKOLECTOR

Reduce finishing costs — step up production with this modern, self-contained variable speed Grinder-Polisher with DusKolector. Lathe has individual, variable speed dial control for each spindle. No "down time" for one operator when the other must increase speed or change wheel. Cyclone DusKolector requires little floor space. Backstand is one of 10 Air and Spring Tension Models to choose from.

Cost reduction through increased efficiency is the need of the day. Write for catalog showing America's most complete line of polishing and buffing machinery.

Hammond Machinery Builders INC.

1601 DOUGLAS AVE. • KALAMAZOO, MICHIGAN

Ultrasonic Cleaning Systems

Acoustica Associates, Inc., Dept. MF, Fairchild Court, Plainview, N. Y.

A new line of ultrasonic cleaning systems is activated by fully-transistorized electronic generators designed to provide new simplicity of operation through automatic tuning and assure maximum cleaning power at a constant rate.

The new miniaturized 20-KC equipment utilizes a newly-devised semiconductor circuit in a completely different operating principle to eliminate all tuning adjustments and meter read-

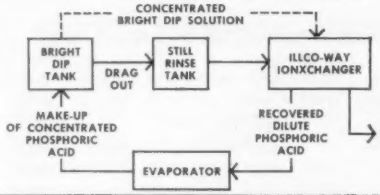
Don't throw it away! **RECOVER YOUR ALUMINUM BRIGHT DIP SOLUTION**

ILLCO-WAY ionXchange

SPECIALIZED EXPERIENCE SHOWS HOW TO SAVE MONEY

The use of ion-exchange eliminates the need for dumping expensive phosphoric acid. Four years of successful experience in recovery of bright dip solutions enables us to make several recommendations, depending on particular conditions. Usually, we employ a cation exchanger to purify the first rinse, recovering phosphoric acid which has been carried over from the bath by dragout. Another treatment removes aluminum direct from the bath. The use of IWT ionXchange can not only improve the uniformity of your product through better quality control in the plating, but also can be a very *profitable* investment.

PROCESS CAN BE USED IN SEVERAL WAYS



The block diagram at the left illustrates the general methods of treatment suggested above. Actually, every installation presents its own special problems — which IWT engineers are well-equipped to solve. *So, consult your IWT representative for specific suggestions.*

ILLINOIS WATER TREATMENT COMPANY

840 CEDAR STREET
ROCKFORD, ILLINOIS

NEW YORK OFFICE: 141 E. 44th St., New York 17, N.Y.
CANADIAN DIST.: Pumps & Softeners, Ltd., London, Ont.

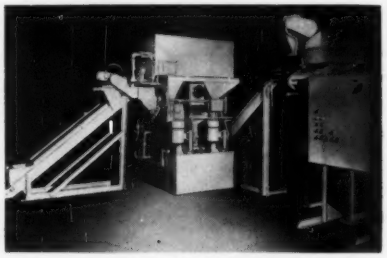
of special interest to the user. This model is being offered either with purely pneumatic action for greatest simplicity, or with a motorized pump for greater output. The packless pump has a special wear plate which prolongs the service life of the unit. Both the impeller and the special wear plate are quickly and easily replaced at very moderate cost. Downtime is virtually eliminated.

The construction is of 3/16″ steel plate, all welded and hot-dip galvanized for long service. Pressure regulator and gage control intensity of blast so that any desired finish and intensity can be obtained.

Features include window washer, movable gun mount, removable hatch for blasting of long parts, high capacity exhaust fan and filter, and instant slurry change. The equipment is fully warranted for one year.

Washing Machine

Ransohoff Co., Dept. MF, Hamilton, Ohio.



A new Ransomatic cabinet type washing machine is designed to clean large tubes, cylindrical shells, and a wide variety of smaller parts used in rocket and missile production.

Parts are put through a complete cycle of automatically timed and sequenced operations which include cleaning, rust-inhibiting, and drying.

Automatic timing of all operations insures uniform process, since the human element is eliminated. Timing can be varied to permit handling four to six work loads per hour.

All processing is done in a single cabinet, with the sprays walking back and forth. The solutions are returned to their respective tanks. This design saves floor space, according to the manufacturer.

Paint Spray Nozzles

Binks Mfg. Co., Dept. MF, 3114 Carroll Ave., Chicago, Ill.

To meet the special conditions inherent in the spray application of

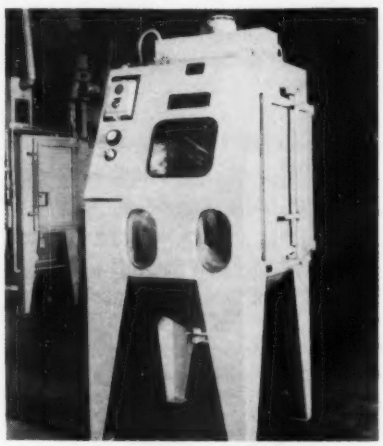
ings, obtaining peak performance from each multipower transducer used in a cleaning tank.

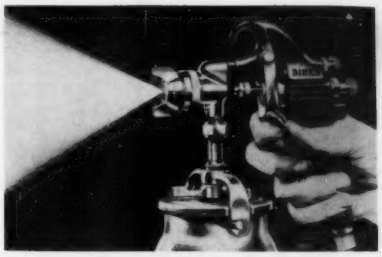
Cleaning speed and efficiency have been greatly increased with the new solid-state circuitry, it is claimed, resulting in additional manufacturing cost savings in ultrasonic cleaning applications. The units react instantly and automatically compensate for changes in both load and liquid levels.

Wet Blast Machine

Metal Improvement Co., Dept. MF, 1721 E. 47th St., Los Angeles 58 Calif.

Peenamatic Model 826, developed through many years of shop experience in glass peening and wet blasting, offers design features which are





polychromatic lacquer and acrylic enamel, a special set of four precision made, low-pressure air nozzles are offered: the 36 SE for Model 7 spray guns, the 66 SG for Model 18, 19 and 29 guns, and the 63 PH and 63 PH-1 for Model 18, 19, 29 and 21 guns. The nozzles are available from stock and ready for immediate delivery.

Since the metallic finishes do not flow as easily as most other paints, it is generally the practice when using standard nozzles to increase the air pressure to insure good flow and more complete atomization. When this is done, a mottling effect results. Reducing the air pressure aids in preventing mottling, but sacrifices good atomization. To retain both the quality of the finish and efficiency of atomization, the new nozzles have been designed to operate at high efficiency at pressures as low as 40 pounds.

Ultrasonic Cleaning Unit

National Ultrasonic Corp., Dept. MF, 111 Montgomery Ave., Irvington, N. J.

This self-contained unit, mounted on large casters for ease of movement and quiet operation, consists of an ultrasonic generator, transducer and counter top. Optional accessories include a 2-5 micron filter and heating elements to maintain liquid temperature from ambient to 160°F.

No connection to drain or plumbing is required since the cleaner is drained by means of a flexible hose connected to the unit. Tanks are positioned off-center to provide a work area on which the baskets can be placed.

The roll-around cleaner, which is simply plugged into a 115 volt line to operate, can be used with solvents, detergents, mild acids, and alkaline cleaners. The tank and counter tops are stainless steel and the cabinet heavy gauge steel.

Vacuum Metalizing Rack

Deco Tools, Inc., Dept. MF, 4321 Harris St., Toledo 13, Ohio.

For vacuum metalizing of plastic parts, either first or second surface for decorative purposes, a combination steel fabricated and electroformed nickel rack permits fast handling and produces sharp trim lines. Photograph illustrates this method as applied to a 1961 automobile arm rest, which holds twelve parts.

ZERO-MIST

world's largest plating supplier

udylite

Zero-Mist can mean cost savings for you.

There is sound reason for the steady increase in the use of Udylite Zero-Mist over the past six years. Users everywhere have learned that here is the *one* mist suppressant that actually *does what it's supposed to do.*

With Zero-Mist you immediately add cash savings to your budget. Here are the six different ways costs conscious platers effect substantial operating economies with Udylite Zero-Mist.

- Eliminate *completely* the health hazard of dangerous chromic acid mist . . . it beats the most stringent code limitations.
- Save expense of chromic acid loss from mist and drag-out.
- Avoid permeating the outside air with destructive fumes.
- Eliminate contamination of adjacent baths.
- Sharply reduce costly waste disposal.
- Reduce equipment maintenance.

the udylite corporation

Before you invest in expensive air wash ventilation and blower equipment, ask your Udylite man what Zero-Mist can do for you.

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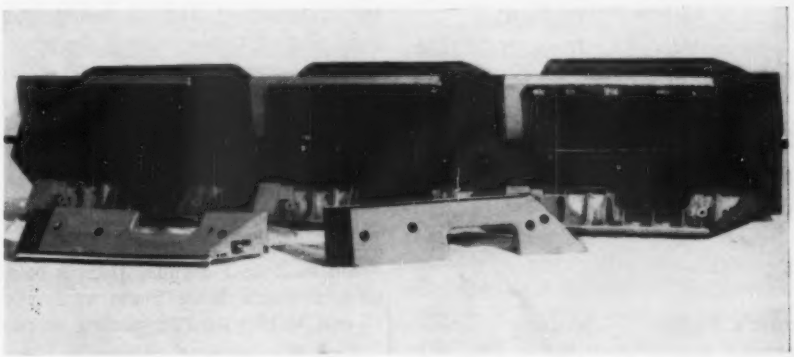

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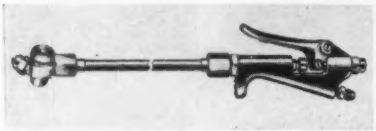
Airless Spray Gun

Binks Mfg. Co., Dept. MF, 3114 Carroll Ave., Chicago, Ill.

A new airless spray painting pole gun, for use with the above manufac-



turer's regular airless spray painting product line, is available in four, six and eight foot lengths.

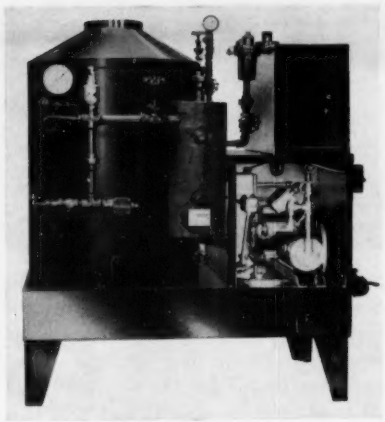
Features of the gun include a 360-degree swivel head which is easily detached for cleaning, a large handle and trigger for ease of handling and good maneuverability, and a convenient paint shut-off needle valve at the tip of the pole.

Steam Generators

Malsbary Mfg. Co., Dept. MF, 845 92nd Ave., Oakland 3, Calif.

Flash-type, continuous-coil steam generators, capable of producing live steam in 2 to 3 minutes from a cold start, now are being made in 5, 10, 15 and 30 bhp sizes for plating shops.

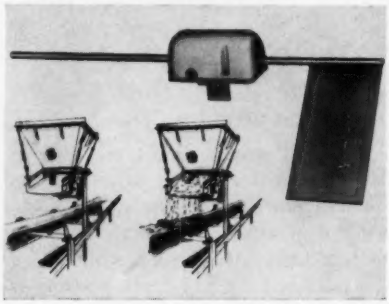
Each is a complete package, so compact it can be installed near the point of use, thus saving expensive piping. For example, the 15 bhp size requires only 30″ x 48″ of floor space, and weighs only 1300 lbs. Installation requires no special foundations, walled-in areas or special insulation; user simply connects steam generator to water, fuel and electricity. The flash-type, continuous-coil produces quick steam without a boiler and is as safe as a home hot water heater; the burner operates only when steam is needed.



All are designed for use singly or in multiples, thus enabling the user to start with one unit and add others as his plant grows.

Flow Switch

Syntron Co., Dept. MF, 732 Lexington Ave., Homer City, Pa.



Flow Switch, Model FS-1, is designed to respond to the lack of material at a critical point in a bulk material handling system and automatically correct the difficulty or sound an alarm.

The switches are sturdily constructed to provide a long trouble-free, maintenance-free life. The shaft to which the flap is attached is mounted in ball bearing pillow blocks. The actuating angle of the flap as it affects the switch is adjustable through 360°.

Switch rating is 1 amp. at 115 volts, 0.5 amp. at 230 volts, AC.

Molded Polyethylene Tanks

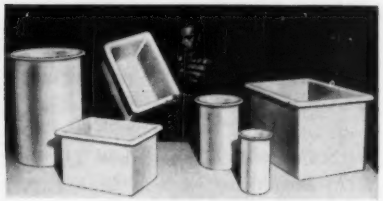
American Agile Corp., Dept. MF, P. O. Box 168, Bedford, Ohio.

A new line of natural color molded

polyethylene tanks, coupling highest quality with dramatic low cost, is now available for one-week delivery, in six standard capacities, from 10 to 55 gallons.

These moldings are self-supporting and of heavy wall construction (⅛″ to ¼″ depending on size capacity).

Detailed specifications: tanks are immediately available in the following sizes — 12″ x 12″ x 18″ with a capacity of ten gallons; 18″ x 18″ x 24″ with a 30-gallon capacity; 36″ x 20″ x 20″ with a 60-gallon capacity; 10″ I.D. x 16″ deep with a capacity of five gallon; 18″ I.D. x 27″ deep with



a 30 gallon capacity; and 22″ I.D. x 33″ deep with a 55-gallon capacity.

Liquid Blast Machine

Hydro-Hone Corp., Dept. MF, 11055 S. Palmer Ave., South Gate, Calif.

Maximum air consumption used by the newly introduced Model 12 liquid blast machine is only 20 cfm at 100 psi. The pump, which is unconditionally guaranteed for one year, is rated at 40 gpm with a ⅓ hp, 110 volt single-phase motor.

Abrasive is changed in the Hydro-

Hone liquid blast machine in only five minutes. Legs are adjustable for operator convenience, or the machine may be bench mounted in limited space areas.

Electrically controlled solenoid valves regulate air supply and the window washing mechanism. Interior of the new machine is 13½ inches high by 20 inches wide. Door opening is 13½ by 10½ inches.

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PATENTS

(*Continued from page* 76)

Anodized Aluminum

U. S. Patent 2,941,282. *June* 21, 1960. *H. A. Fromson.*

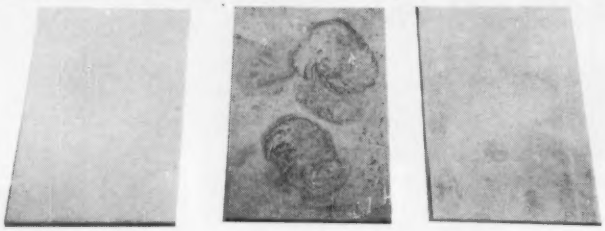
An article having a decorative surface of anodized aluminum, which comprises at least two pieces of aluminum metallurgically bonded together as a unit, one of said pieces forming a base and extending beneath the other of said pieces, said pieces being of different compositions and different light reflectivity when anodized, said unit having an anodized composite surface in which portions of both of the pieces are visible with the difference in light reflectivity of the two pieces defining a pattern on said composite surface.

Airless Spray Unit

U. S. Patent 2,941,726. *June* 21, 1960. *H. Szczepanski.*

A liquid-supply system providing a

Now! MAXIMUM SMUT REMOVAL



After cleaning in Anodyne HD | Before cleaning | After cleaning in "X"

A comparison showing the superiority of Kelite Anodyne HD over a typical anodic steel electrocleaner.

at high current density with

KELITE ANODYNE HD

in fully automatic operations

Anodyne HD provides high conductivity and a superior ability to remove oxide and carbon deposits from steel and buffed copper. Even at current densities up to 150 amperes per square foot, this anodic cleaner does not attack the metal being cleaned. A foam blanket is generated to trap alkaline spray produced in electrolytic cleaning. This foam blanket is brittle so that it breaks before becoming too thick for the automatic equipment.

For further information or a Product Bulletin, contact the nearest Kelite office listed below.

KELITE CORPORATION

• Los Angeles 12 • Chicago 45 • Berkeley Heights, N. J.

spray liquid having a volatile component, said system maintaining said liquid at a pressure and temperature corresponding to that of the liquid condition of said component and a spraying device.

Electroless Nickel

U. S. Patent 2,941,902. *June* 21, 1960. *P. Talmey and W. J. Crehan, assignors to General American Transportation Corp.*

A method of depositing a metal from a chemical reduction type plating bath, said method comprising the steps of immersing an article to be coated into said plating bath which is maintained at an elevated temperature and is continuously recirculated through a filter, said plating bath being rapidly cooled before it enters said filter in order to preclude the plating reaction in said filter.

Anodized Aluminum

U. S. Patent 2,941,930. *June* 21, 1960. *N. Mostovych and W. A. Mitchell, Jr., assignors to Reynolds Metals Co.*

In a method of ornamenting and decorating aluminum base metal from the class consisting of aluminum and aluminum base alloys, the improvement comprising providing said metal in a dead-annealed condition with its grains minute in size, cold-deforming said metal equivalent to a reduction of approximately 1% to 15% in thickness thereof, heating the cold-deformed metal for recrystallization to a temperature of about 600°F. to 1,150°F. for approximately ten minutes to three hours to develop large crystals in the metal body, said crystals having faces of microscopic size which are visible on the metal surface after etching the surface of said metal in an etching solution to clearly expose said crystal faces and their boundaries at said metal surface, making the metal the anode of an electrolytic anodizing bath and forming a corrosion-resistant transparent film of aluminum oxide integral with the metal on said crystal faces and sealing said film to render it non-porous, whereby upon viewing said crystal faces through said film, different shadings are seen which differ from crystal face to crystal face.

Ultrasonic Cleaning

U. S. Patent 2,941,908. *June* 21, 1960. *J. R. Logan, assignor to Bendix Aviation Corp.*

The method of extracting contaminants from a fluid-permeable body which comprises subjecting the body to the action of ultrasonic waves and simultaneously to a series of alternating higher and lower external fluid pressures.

Steam Cleaner

U. S. Patent 2,942,788. *June* 28, 1960. *W. Clayton, assignor to Clayton Mfg. Co.*

Cleaning apparatus adapted for use with a source of cleaning liquid and a source of pressured fluid.

Pickling Inhibitor

U. S. Patent 2,941,949. *June* 21, 1960. *A. J. Saukaitis, assignor to Amchem Products, Inc.*

A mineral acid bath for cleaning and pickling metal surfaces, said bath containing, as an inhibiting addition agent, an amount of triphenyl sulfonium chloride which is sufficient to reduce the rate of acid attack on metal.

Spray Painting Apparatus

U. S. Patent 2,942,787. *June* 28, 1960. *H. F. Bok and E. Bok.*

A spray painting apparatus comprising a pressure tank having a resistance heating element for evaporating a volatile paint thinner mounted in said tank; a vapor circuit attached to said tank and including at an intermediate portion a spray gun; a paint

supply tank; and a paint circuit leading from said tank to said spray gun and abutting said vapor circuit for preheating of the paint to be sprayed.

Chemical Plating

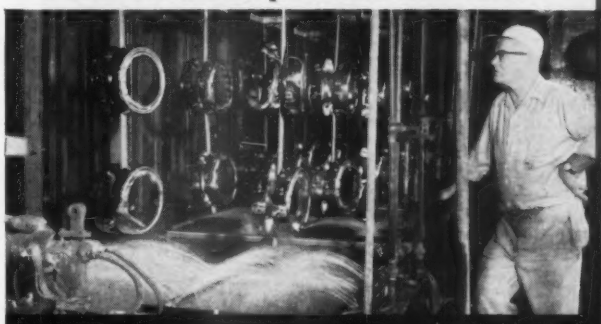
U. S. Patent 2,942,990. *June* 28, 1960. *E. A. Sullivan, assignor to Metal Hydrides, Inc.*

A bath for plating by chemical deposition consisting essentially of an aqueous solution of a salt of a metal selected from the group consisting of nickel and cobalt in a concentration between about 0.02 and 0.15 normal, a borohydride selected from the group consisting of sodium borohydride, potassium borohydride and tetramethylammonium borohydride, an alkaline material selected from the group consisting of ammonium hydroxide, an alkali metal hydroxide and tetramethylammonium hydroxide in an amount sufficient to bring the pH of the solution to between about 12.0 and 13.0, and an agent adapted to inhibit precipitation of the hydroxide of said selected metal, said agent being selected from alkali metal salts of carboxylic acids having at least two carboxyl groups and being present in a concentration in terms of normality at least equal to the normality of the salt of said selected metal.

a **Udylite** customer discovers . . .

HOW TO GAIN 2 MAJOR BENEFITS WITH 1 GREAT NICKEL PROCESS

The incomparable "66"



The Dominion Electric Corporation has made a marked improvement in the appearance and reduced the cost of finishing its products.

With the Udylite bright nickel process "66" this Mansfield, Ohio electrical appliance manufacturer now achieves a dramatic, high color finish that resembles "fine jewelry." And, this finer finish is obtained with a simplified processing cycle at considerably lowered cost.

The incomparable "66" is credited with a real contribution toward keeping Dominion in the front ranks of the appliance industry.

Perhaps it may be just the finish that your product needs. Look into its possibilities . . . see what a beautiful job it does. Ask your Udylite man about test plating your samples today. Or write direct to:

world's largest plating supplier

udylite

This Dominion Electric 4 slice toaster gains beauty and utility from its lustrous Udylite "66" finish that makes it highly attractive and easy to care for.

the udylite corporation

detroit 11, michigan

on the west coast: L. H. Butcher Co.

BUSINESS ITEMS

Heatbath Appoints Technical Sales Representative

Heatbath Corp. announces the appointment of *Jim McDonald* as technical sales representative in central and western Illinois and Iowa. Mr. McDonald will work out of the Chicago office at 701 North Sangamon St., Chicago 22, Ill. Telephone: Taylor 9-4545.

Jim McDonald

Irvin Elected Director of Southern States Industrial Council

Harry C. Irvin, president of *Allied Research Products, Inc.*, was recently elected a member of the Maryland board of directors of the Southern States Industrial Council. The Council is composed of executives from all types of business and industry in sixteen southern states, from Texas to Maryland.

Harper Ransburg Honored

Harper J. Ransburg, president of *Harper J. Ransburg Co., Inc.* and *Ransburgh Electro-Coating Corp.*, was

Mr. Ransburg, right, receiving plaque from Mr. Book.

Here's the
PHOSPHATE COATING
You asked TURCO TO MAKE

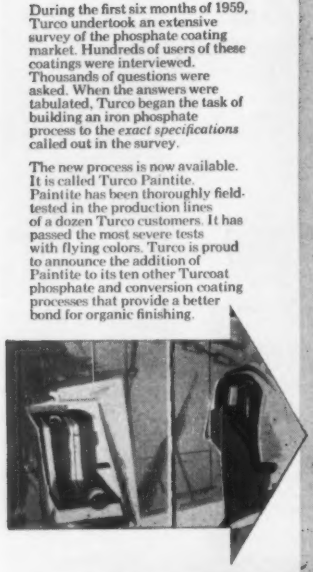
HERE'S HOW PAINTITE SCORES ON SURVEY'S 12 "MOST WANTED" FEATURES...

—Formulated as Result of Industry-Wide Survey...

During the first six months of 1959, Turco undertook an extensive survey of the phosphate coating market. Hundreds of users of these coatings were interviewed. Thousands of questions were asked. When the answers were tabulated, Turco began the task of building an iron phosphate process to the *exact specifications* called out in the survey.

The new process is now available. It is called Turco Paintite. Paintite has been thoroughly field-tested in the production lines of a dozen Turco customers. It has passed the most severe tests with flying colors. Turco is proud to announce the addition of Paintite to its ten other Turcoat phosphate and conversion coating processes that provide a better bond for organic finishing.

1. **SUPERIOR CLEANING**–Exclusive wetting system provides heavy-duty uniform cleaning. Cleans & phosphates simultaneously.
2. **TEMPERATURE VERSATILITY**–Efficient anywhere within range of 140° to 180°F. Temperature control is not important.
3. **LOW FOAMING**–at any temperature within recommended range.
4. **LESS POST RUST**–Eliminates post rusting problem often encountered with iron phosphate processes.
5. **NO WHITE STREAKING**–Extra free rinsing. Leaves no residue.
6. **ECONOMICAL**–Low in initial cost. Low in maintenance cost. Low in cost per sq. ft. Long-lived, even under mass production use.
7. **UNIFORM COATING**–even on edges and points. Won't show through on low-pigmented paints.
8. **USE VERSATILITY**–used by immersion, spray washer or steam cleaner.
9. **LESS SLUDGE**–less scale. Minimizes clean-up problems.
10. **RESERVE ACIDITY**–combats alkaline water conditions. Constant control not necessary.
11. **SUPERIOR SERVICE**–by Turco's vast network of technically trained servicemen, located in industrial centers throughout the world.
12. **REQUIRES ONLY 3 STAGES**–for dip or spray washing. Can be efficiently used in 5-stage operations, if desired.



FREE! VALUABLE BOOKLET
PHOSPHATING REFERENCE CHART
TECHNICAL DATA BULLETIN

Get the full story on Paintite and the other ten phosphating and conversion coating processes in the complete Turcoat line. Write for your copy, along with Turco's Phosphating Reference Chart, today!

TURCO PRODUCTS, INC.
Chemical Processing Compounds
24600 South Main Street, Wilmington, California
FACTORIES: Rockdale, Ill., Houston, Wilmington, London, Rotterdam, Sydney, Mexico City, Paris, Hamburg, Montreal, Manila, Naha (Okinawa)
Offices in All Principal Cities

TURCO PRODUCTS, INC.
24600 South Main St., Wilmington, Calif.
MERELY AFFIX COUPON TO COMPANY LETTERHEAD
Please send valuable booklet with Phosphating Reference Chart and full details on Paintite. I understand there is no cost or obligation on my part.
NAME
TITLE
MF

honored recently at a luncheon meeting at the Indianapolis Athletic Club. He was presented with a plaque commemorating his fiftieth anniversary in business by *Wm. H. Book*, executive vice-president of the Indianapolis Chamber of Commerce.

Leander Elected President of Mystik Adhesive Products, Inc.

Robert J. Leander has been elected president of *Mystik Adhesive Products, Inc.*, Chicago-headquartered manufacturer of pressure-sensitive tapes and other adhesives specialties. He succeeds *Russell J. Leander*, founder of the company, who has been elected chairman of the board. *Robert D. Smith* has been named executive vice president.

Moore Appoints Birge Distributor

The Synflex Products Division of *Samuel Moore & Co.*, Mantua, Ohio, announces the appointment of the *R. B. Birge Co.*, 22 Webster Ave., Bridgeport 7, Conn. as its master stocking distributor for the state of Connecticut. They will stock the complete line of Synflex industrial nylon hoses.

Brown New Sales Rep. for Geigy

Geigy Industrial Chemicals Division of *Geigy Chemical Corp.* announces the appointment of *Joseph W. Brown* as field sales representative, with headquarters in Los Angeles. He will represent the division in California, Nevada, Utah, Arizona, and Colorado.

Mr. Brown received his B.A. in chemistry from the University of Connecticut in 1950. He was formerly associated with American Potash and Chem. Corp. as technical service representative.

Westinghouse Appoints Ultrasonic Cleaning Distributors

Production Methods Co., of 2941 Touhy Ave., Chicago, Ill., has been appointed distributor in Illinois, Wisconsin and in Northwestern Indiana for ultrasonic cleaning equipment produced by *Westinghouse Electric Corp.*

The Chicago firm headed by *Marvin Klein*, is a distributor of metal cleaning and finishing equipment.

Deakyne Joins Van Straaten Chemical Co.

Dean J. Deakyne has been named assistant general sales manager of the *Van Straaten Chem. Co.*, Chicago. He was formerly sales engineer with the Celanese Corp. of America, and the Parker-Hannifin Corp., and has previous experience with the E. F. Houghton and Co. and Sun Oil Co.

Deakyne, a native of Pennsylvania, has a bachelor degree in chemistry from the University of Pennsylvania. He has graduated from the navy school of radar and electronics, and various other special private courses of instruction in jet engine familiarization, metallurgy, hydraulics and industrial lubrication. He is a member of the American Society Lubrication Engineers and the National Society of Die Cast Engineers.

Dickens Joins Enthone

James L. Dickens has joined *En-*

James L. Dickens

thone, Inc. of New Haven, Conn., as a technical service chemist in the firm's laboratory.

Mr. Dickens received a degree in chemistry from Broome Technical Community College, Binghamton, N. Y. and attended Cornell University. He was previously employed as a research chemist by the Solvay Process Division of Allied Chemical Corp. in Syracuse, N. Y.

Nu-Matic Grinders, Inc. Appoints Southern Representative

Clyde Lanham, 4029 Fairmont Way North, Birmingham, Ala., has been appointed by *Nu-Matic Grinders, Inc.*, manufacturers of inflated and expanding finishing wheels, to be their exclusive representative in the states of Florida, Alabama, Georgia, Mississippi, Tennessee as well as Baton Rouge and New Orleans.

Mr. Lanham's experience includes a wide knowledge and wide experience in the field of coated abrasives, both in selling as well as in purchasing.

Nadel Joins Levco

Levco Metal Finishers, Long Island City, N. Y., announces the appointment of *Milton Nadel* as general plant manager.

The firm has started a project for modernizing and increasing its present facilities. Additional property has been purchased for its expanding business.

Mr. Nadel has been with Berkeley Industries for the past fourteen years as supervisor of metal finishing of all their divisions. Educated at the University of Alabama and Polytechnic Institute of Brooklyn, Mr. Nadel has spent many years in furthering educational facilities for the plating fraternity. Past president of the New York Branch of the A.E.S., he is at present its secretary-treasurer. Among his many other activities, Mr. Nadel is also the convention chairman for the 1965 A.E.S. convention.

Milton Nadel

Look! before you junk
at the Udylite
Project Alert Barrel Program
Hundreds of barrel units have already passed through our Project Alert lines. Every job from the simplest repair to complete renovation has meant equipment salvaged—its useful life extended and real cash savings for plating operators everywhere.
Through Project Alert, barrels in any condition are renovated and returned to the line. The program is flexible . . . it provides the exact restoration necessary to put each crippled unit back into productive use. It works! . . . it has proven a valuable economy for hundreds of satisfied Udylite customers.
Get "extra mileage" from your tired, worn out barrel equipment. Ask your Udylite man now or contact Lee Morningstar at Udylite today. .
Lee Morningstar who personally supervises every single Project Alert Barrel order.
PROJECT ALERT
world's largest plating supplier
udylite
the udylite corporation
detroit 11, michigan
on the west coast: L. H. Butcher Co.

Enthone Appoints French Licensee

Enthone, Inc. of New Haven, Conn., has announced the licensing of *Pernix Grauer & Weil* of Paris to manufacture, sell, and service its products in France, Belgium, Spain, Portugal, and French Overseas Territories.

Pernix Grauer & Weil is one of the largest manufacturers of plating and polishing equipment in France and a supplier of plating chemicals. It maintains extensive research, analytical, and material testing laboratories at its main offices at 76 Boulevard Richard-Lenoir in Paris. Manufacturing facilities are located at La Varenne-Saint-Hilaire near Paris and branch plants are operated in Belgium and Spain. Enthone metal finishing chemicals will be manufactured at all three locations.

Snyder Appointed by Moore

Burton E. Snyder has been appointed sales correspondent of the Synflex Products Division of *Samuel Moore & Co.*, Mantua, Ohio, manufacturer of nylon, PVC and polyethylene tubes and hoses for industry. Snyder has been with the company fifteen years.

Deering, Milliken

RESEARCH AND CONTROL

From cotton...
to yarn...
to cloth...
to buff...

RESULTS IN SUPERIOR BUFF CLOTHS

Averaging "Over-Averages"

We use two length averages when checking the cotton fibers that go into the manufacture of the different styles of Milliken Buff Cloths.

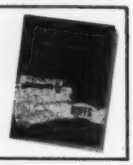
a . . . We first average the lengths

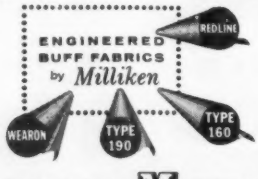
b . . . We then average the length of all fibers longer than the average length

Why do we do this? To determine the 'uniformity ratio' of each sample. If this ratio does not hold to our high standard, we reject the lot. The over-long fibers add strength to the yarn.

Continuous checking and testing at the Milliken Laboratory assures that only the highest quality cotton fibers go into Milliken Buff Cloths. We trademark these cloths because we believe that you, the user of buffs, want to know that you can hold Milliken responsible if one of our trademarked cloths does not hold to its high standard and produce results comparable with those outlined. →

Have you read the Story of Deering, Milliken Research and its part in the development of the line of Milliken Buff Cloths? If not, let us know and we'll be glad to send you a copy. You will find it both interesting and informative.





DEERING, MILLIKEN & CO., INC.

1045 SIXTH AVENUE • NEW YORK 18, N.Y.

Buff Values resulting from

Deering, Milliken

Research and Control

Increase in Production per Buff

...25 to 30%

As Against an Increase in Buff Cost

...15%

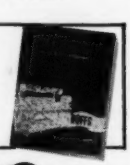
As Reported by
Yankee Metal Products Corp.
Norwalk, Connecticut

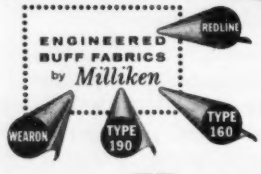
This represents a substantial net saving in buff cost per piece finished. It came about when the company changed over to Milliken Wearon® Cloth. The company also tested out Milliken 190 Cloth on other products and found that it, too, saved in production costs. Now, for all new jobs, Milliken cloths will get the call.

As for trademarking on cloths, here is what this buff user has to say, "We believe that the idea of marking their cloths has been a boon to users such as ourselves because for the first time we are able to specify exactly the cloth we want and be sure of getting it."

Milliken Buff Cloths not only are superior but bring about net savings in cost. They are worthy of a full competitive test in your finishing department. Why not have your supplier make up test wheels in all four styles —Wearon, 190, 160 and Redline. Then make as severe a series of tests as you like.

This 12-page brochure tells about our extensive research, testing and control facilities starting with the cotton fiber through to the finished cloth. Would you like a copy?





DEERING, MILLIKEN & CO., INC.

1045 SIXTH AVENUE • NEW YORK 18, N.Y.

Beck Changes Name

Effective October 1st *Beck Equipment Co.* has changed its name to *Beck Equipment & Chem. Co.* The new name better describes the expanded line of chemical products, processes and services offered by this 14 year old company.

The modern plant, offices and laboratory are located at 3350 West 137th Street, Cleveland 11, Ohio.

Seymour Mfg. Co. Promotes Cobb

The promotion of *Russell T. Cobb* to assistant sales manager has been announced by *Seymour Mfg. Co.*, Seymour, Conn. He joined the firm in 1958 as manager of marketing research. When the company went into the production of stainless steel in 1959, he became manager of sales of stainless steel, while continuing his work as marketing research manager. In his new position he will retain his marketing and advertising responsibilities.

Mr. Cobb was previously with General Electric Co. in Bridgeport, Conn., and Louisville, in the field of marketing and distribution research, and later was associated with the American Car and Foundry Division of ACF Industries, as senior market analyst. He attended the University of Connecticut, majoring in civil engineering, and received a B. S. degree in marketing from the University of Bridgeport. He is a veteran of the 48th Infantry Division in World War II.

H-VW-M Promotes Carlson and Nortof

Hanson - Van Winkle - Munning Co.

Everett E. Carlson

Albert A. Nortof

has announced the promotions of *Everett E. Carlson* and *Albert A. Nortof* to the positions of chief chemist and process electrochemist respectively.

Mr. Carlson, who joined the firm in 1939, was until recently manager of service laboratories. He previously was a member of the plans department of a large abrasive manufacturer. In his new position, Mr. Carlson will be responsible for all functions of the Matawan general laboratory, including customer service, plating facilities, and the analytical laboratory. He is an active member in the A.E.S. and holds a B.S. in chemistry from the University of Vermont, class of '34.

Mr. Nortof has recently transferred from the Cleveland office, where he was a field electrochemist, to accept his new post at the company's New Jersey headquarters. Prior to joining the company in 1953, he was an officer in the U. S. Army, serving in the Chemical Corps. He is a 1950 Rutgers University graduate and holds a B.S. degree in chemistry. He is a member of the A.E.S.

Mr. Nortof's chief duties will be the dissemination of technical information among the company's service personnel and customers and assisting technically in the application of electrochemical processes and products.

Automotive Rubber Appoints Rogers

Announcement has been made by the *Automotive Rubber Co.* of Detroit of the appointment of *Philip T. Rogers* as vice-president and general manager of its ARco-Wynn Valve Division.

Rogers, formerly a regional manager

Load to SPIN-spray

much faster

with new

"Ride-the-Rod" Coating Machine

Big Savings are being made with this new machine, especially on multiple-coat operations.

Each part to be coated is loaded to a work-holder on a spindle—but the spindles are **on Carrier Rods, independent of the chain.**

Placing one Carrier Rod on the machine

LOADS 20 OR 30 PARTS AT ONCE

Lifting off the Carrier Rod unloads all the parts, and they stay on the rod through all stages of painting and baking— single or multiple coats.

Rejects are far less: No finger marks on parts wet with coating, because parts are not handled.

Ideal equipment for the vacuum metallizer to apply base coat, bake and metallize, top coat and bake . . . and metal painting when you prime, bake, finish coat and bake. All done with parts left on the rods.

ROTATING SPINDLES or non-rotating work-holders are used with the "Ride-the-Rod" machine, as required for uniform coverage.

You save machine time when changing from one coating job to another— there's no down time with the "Ride-the-Rod" machine. The operator puts new work-holders on the Carrier Rods in advance— all ready for the change.

For long runs parts can be loaded on the Carrier Rods automatically, and coated at up to 30,000 per hour.

Machine speed is adjustable from 200 to 600 Carrier Rods per hour.

Part rotation speed is also adjustable to suit the job, independently of Carrier Rod travel speed.

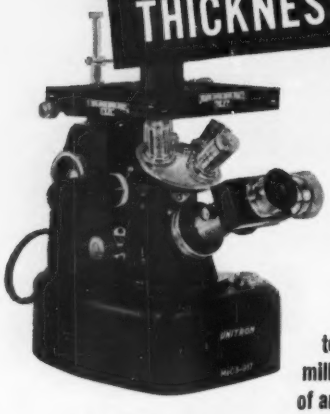
For limited production the "Ride-the-Rod" machine can be used like an ordinary chain machine, with the Carrier Rods left on.

Furnished with either dry type or water-wash spray booth. For further details, write or phone FINISH ENGINEERING CO., INC., 921 Greengarden Road, Erie, Pa., Phone GL 5-4478.

FINISH ENGINEERING CO., INC.

WHY GUESS ?

MEASURE PLATING THICKNESS

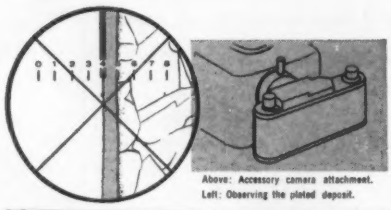


to a millionth of an inch

Your profits depend on meeting tight specifications, maintaining quality control and reducing rejects. Can you afford to guess at plating thickness when it is so easy to *measure and be sure*?

UNITRON'S PL-MEC PLATER'S MICROSCOPE substitutes facts for uncertainty. The plated deposit is observed through a Filar Micrometer Eyepiece and measurements are read directly from a micrometer drum. This compact microscope is easy to use, portable around the shop and has a built-in light source. It also doubles as a metallurgical microscope for examining grain structure etc. at magnifications of 25X-1500X. Permanent photographic records may be made using an accessory 35mm. camera attachment and provide valuable legal protection for subcontractors.

UNITRON'S PLATER'S MICROSCOPE will save its initial cost many times over. Prove this for yourself — as so many firms in the plating industry have done—by requesting a **FREE 10 DAY TRIAL** in your own plant. There is no cost and no obligation.



Above: Accessory camera attachment.
Left: Observing the plated deposit.

$468 Model PL-MEC complete with all optics and standard accessories	As above with built-in camera attachment, but without 35mm. camera back: $540

THE TREND IS TO UNITRON

UNITRON

INSTRUMENT COMPANY • MICROSCOPE SALES DIV.
66 NEEDHAM ST., NEWTON HIGHLANDS 61, MASS.

Please rush UNITRON's Microscope Catalog 13-1

Name .....

Company .....

Address .....

City ..... State .....

Philip T. Rogers

Gustave A. Hoffman

for the Hills-McCanna Co. of Chicago, will direct the firm's expansion on a national scale in the valve industry.

Beckwith on Board of Directors of Rinshed-Mason

Newell P. Beckwith, vice president of the Rinshed-Mason Co. of Canada, has been appointed to its board of directors.

Bendheim to Head New Plastics Division of L. H. Butcher

Richard W. Bendheim has been appointed to head the newly created Plastic Division of the *L. H. Butcher Co.*, a subsidiary of *The Udylite Corp.* in Detroit.

Mr. Bendheim, formerly director of sales for the Chemical, Ceramic and Paint Divisions of the company, will organize the new division as a specialized segment within the company structure to afford more effective sales concentration to the rapidly growing plastic industry.

Hoffman Named Walworth Vice-President, Sales

Walworth Co., the nation's oldest valve and fitting manufacturer, has announced the appointment of *Gustav A. Hoffman* as vice-president, sales. He will be returning to the company he served for 27 years. He left in the Spring of 1959, while holding the position of assistant vice-president in charge of Metropolitan Division Sales.

Mr. Hoffman joined the company in 1932. He entered company sales four years later and was appointed sales manager of Philadelphia area in 1940. He returned in 1946 after four years of service in the United States Navy where he held the rank of Lieutenant Commander. He subsequently managed the Kansas City and Detroit sales areas prior to being appointed manager of the Metropolitan Division in 1955.

Binks Establishes Customer Demonstration Department

To meet the increased demand for customer service brought about by the expansion and diversification of its product line, *Binks Mfg. Co.*, Chicago, has established a Customer Demonstration and Service Department.

Specifically, it will perform the following duties:

1. Test and evaluate material samples submitted by customers, and make recommendations as to the type of equipment that will best spray the material being evaluated.

2. Conduct material and product application tests on all automatic and electrostatic equipment, as well as on the firm's own pump line.

The new department will have at its disposal all of the company's existing laboratory facilities. Equipped with the latest spray painting equipment and testing facilities, the laboratory will perform comparative testing that will assist the customer in choosing the right finishing material and equipment for his own particular needs.

Ransohoff Co. Appoints Technical Director

John R. Strom, chemist and process engineer for the *Roto-Finish Co.*, Kalamazoo, Mich., has been appointed to the newly created post of technical director of the *Ransohoff Co.*, Hamilton, Ohio. Both companies are under the same management.

John R. Strom

Kurt F. Vogt

For the past year Strom has had charge of the development of finishing compounds and metal cleaners for the two companies. Before joining Roto-Finish in 1958, Strom was a process engineer for Brown-Lipe-Chapin Div. of General Motors, and plating superintendent for the Eljer Co. of Marysville, Ohio.

Strom took his chemical engineering degree from Baldwin College in 1951. He is a member of the A.E.S.

American Smelting Appoints Vice President for Mexico

Walter J. Nock has been appointed vice president in charge of the Mexican Division of *American Smelting and Refining Co.*, according to a recent announcement. The division includes all of the company's properties, sales activities and other interests in Mexico.

Mr. Nock was formerly general manager of the Mexican Mining Department.

Vogt V.P. of Marketing for Acoustica

Appointment of *Kurt F. Vogt* to the newly-created position of vice president-marketing for *Acoustica Associates, Inc.*, manufacturer of ultrasonic instruments and systems, was announced recently.

Vogt, who joined the firm in 1959 as director of marketing, formerly was associated with Ritter Co., Inc., of Rochester, N. Y., as marketing manager; with Air Reduction Co., Inc., New York, as assistant sales manager; and was a marketing consultant for the Siemens Co.

During World War II, he served the Office of the Surgeon General as an instructor in the use of medical equipment. Prior to entering the service, he was assistant general manager of the Phillips Metalix Corp. of New York City.

Vogt is a cum laude graduate of Harvard where he received a B.S. degree in economics-marketing. He also founded the Harvard Business Economics Council and subsequently did graduate work at Washington and St. Louis Universities.

Vogt is a member of the American Management Association, the American Marketing Association, the Harvard clubs of New York City and Rochester, and is a past first vice president of the Junior Chamber of Commerce of New York City.

Hagan Joins Hubbard-Hall

The *Hubbard-Hall Chem. Co.*, Waterbury, Conn., has announced the appointment of *John J. Hagan* to its staff. In his new position, Mr. Hagan will act as assistant to *Frederick S. Foster*, vice-president in charge of the Heavy Chemical Department of the Industrial Division.

Before joining the firm, Mr. Hagan was New England sales representative for the Anti-Freeze Division of Commercial Solvents, recently purchased by Houston Chem. Co. A graduate of Suffolk University, he also did graduate work at Boston College.

Naves Named Regional Sales Engineer for Technic

Gerald J. Naves, Jr., of Danbury, Conn., has been appointed eastern regional sales engineer for *Technic, Inc.*, Providence, R. I.

Formerly assistant manager of Dan-

Sethco

submerged
UNIVERSAL
FILTER
SYSTEM

faster, full-view filtration for all corrosive solutions

- compact, leakproof, non-aerating, continuous duty
- easy, trouble-free operation
- cartridge has heavier load capacity, replacement made in seconds
- fits anywhere on tank — saves floor space, no "jockeying" with hose lines
- high speed ⅓ hp motor for faster flow
- completely corrosion resistant
- quality-built throughout yet costs ⅓ less than heavier, cumbersome types

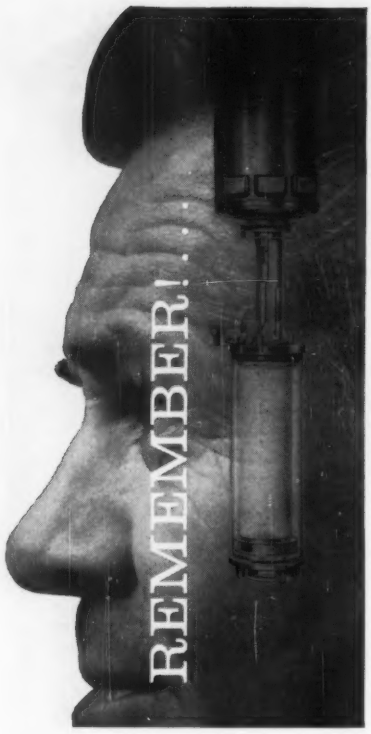
Sethco — famous for many firsts in filtration systems — now offers a completely new concept in a submersible type unit. Designed for filtering plating and chemical solutions without "product" loss, the new SUB series represents the ultimate in reliability and economy. Only Sethco provides a choice of construction for universal applications: for acids and alkalies — lucite and epoxy with SS #316 fittings; for temperatures above 140°F. — epoxy and full-view pyrex shell replaces lucite; for high chlorides — epoxy or titanium replaces SS #316.

Write or call for Spec Sheet No. 551

Sethco
MANUFACTURING CORP

2286 Babylon Tpk., Merrick, L.I., N.Y.
MAyfair 3-4220

DEPTH FILTRATION FOR ALL ELECTROPLATING AND INDUSTRIAL APPLICATIONS • METAL FINISHING • PHOTO PROCESSING • PETROLEUM • SOLVENTS • LACQUERS • PHARMACEUTICALS • ULTRASONIC CLEANERS • RADIOACTIVE SOLUTIONS • WATER • ELECTROTYPING



new

WINSCOTT FILTER

for faster, higher quality plating at lower cost

- Keeps surface clean regardless of solution level.
- No solution loss due to leaks. Most important in precious metal solutions.
- Entire filtering unit submerged in tank, cannot aerate solution.
- Requires only small space in tank . . . no equipment in aisles.
- Large, easy-to-clean filter area.
- Corrosion-resistant construction throughout.

Exclusive National Sales Representative

THE CHEMICAL CORPORATION

Makers of Luster-On® chromate conversion coatings for zinc, cadmium, copper, brass, aluminum —

The Chemical Corporation

58 Waltham Avenue, Springfield 9, Mass.

Gerald J. Naves, Jr.

bury Metal Finishing Co., Naves has studied at Danbury State College, Bridgeport University, and New Haven College. He also has developed an accelerated technical course for electroplating apprentices.

Naves is a member of the A.E.S. and the U. S. Junior Chamber of Commerce and is a veteran of navy service.

Smith Joins H-VW-M; Muscarella Transfers

Carl R. Smith has joined *Hanson-Van Winkle-Munning Co.* as sales representative in the Kentucky-Tennessee territory with headquarters at Louisville. He replaces *Joseph P. Muscarella, Jr.*, who has transferred to the company's Philadelphia territory.

Prior to joining the firm Mr. Smith was associated in a sales capacity with a leading chemical manufacturing firm, serving the metal finishing industry. He has had wide experience in metal

Carl R. Smith

YOUR direct line for a COMPLETE LINE of DEPENDABLE

PLATING ANODIZING FINISHING EQUIPMENT & SUPPLIES

MUNNING products economically meet every requirement of the Plating and Polishing Industry

featuring

SELENIUM RECTIFIERS

CAPACITIES FROM 25 TO 10,000 AMPS., MAXIMUM VOLTAGE FROM 6 TO 60 VOLTS

MUNNING

MUNNING & MUNNING, INC.
202-208 EMMETT ST.,
NEWARK 5, N. J.

Joseph P. Muscarella, Jr.

finishing, especially in electroplating.

Mr. Smith is a 1957 graduate of Bellarmine College of Louisville. He is an active member of the American Society for Metals and the A.E.S.

Mr. Muscarella joined the company in 1953 as a sales engineer in the general equipment section, spending his first four years headquartered at the main offices in Matawan, N. J., and the remaining three years in the Louisville area.

Mr. Muscarella holds a B.S. degree from Rutgers University and is a member of the A.E.S.

Firth Heads Marketing Program for Udylite

Frank E. Firth of Milton, Mass., formerly in government service with the Departments of State and the Interior, has been named engineering promotion manager, Rubber and Plastic Products, to head the marketing program for CPD-10, a neoprene lin-

Frank E. Firth

which stack
would YOU use for
corrosive fumes?
8888-CC
This stainless steel stack failed after only 6 months in corrosion service!
Over 2 years old . . . yet this Duracor stack shows absolutely no signs of attack inside or outside!

DURACOR VENTILATING SYSTEMS PROVIDE LASTING CORROSION RESISTANCE AT LOW COST!

Performance-proven Duracor Ventilating Systems and components provide outstanding resistance to attack from all types of corrosive fumes. These high-strength systems are corrosion-proof throughout . . . are practically immune to weathering . . . require only minimum support! Best of all, Duracor construction can save you up to 30% on your initial investment . . . and it's maintenance-free! Ceilcote engineers will design a complete Duracor system to meet your special requirements . . . or modify your present system to permit gradual conversion to Duracor. Fabricated to meet customer specifications . . . or assembled from stocked component parts . . . Duracor Ventilating Systems can be easily installed by regular plant maintenance crews or by experienced Ceilcote installation personnel. Write today for the new Ceilcote catalog.

DURACOR CEILCOTE

ANOTHER PRODUCT OF

THE CEILCOTE COMPANY, INCORPORATED

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ing precured by a radio frequency energy process.

Previously, Mr. Firth was manager of the Linings Division of Chase & Sons, Inc., of Randolph, Mass. He is a Fellow of the American Institute of Chemists, and a member of the New York Academy of Science, National Association of Corrosion Engineers, American Electroplaters' Society, Chemical Market Research Association, American Ordnance Association and the American Boat & Yacht Council.

A graduate of Harvard University (Class of 1936), Mr. Firth is co-author of "Marine Products of Commerce," and author of 22 scientific, technical and general articles published in national magazines.

Oakite Names Kornett to Board

Peter J. Kornett has been elected to the board of directors of *Oakite Products, Inc.*, manufacturers of specialized chemical compounds for industrial cleaning and metal treating.

Mr. Kornett, a graduate of the College of the City of New York, joined the firm in 1941 as a control chemist. He is now the company's general manager of manufacturing.

American Brass Co. Changes Name

American Brass Co., one of the nation's largest copper and brass mill product manufacturers, has officially changed its name to *Anaconda American Brass Co.*

A wholly owned subsidiary of The Anaconda Co., Anaconda American Brass will continue to have its headquarters in Waterbury, Conn. with mill operations in Ansonia, Torrington and Waterbury, Conn.; Buffalo, N. Y.; Detroit, Mich.; Kenosha, Wis.; Paramount, Calif.; and Mattoon, Ill. The Canadian subsidiary is Anaconda American Brass Ltd., and is located in New Toronto, Ont.

Hooker to Make and Sell Perchlorethylene in West

Perchlorethylene, a chlorinated solvent, will be made and sold in the West by *Hooker Chemical Corp.*, it was announced recently. The new production unit is now being installed at the Western Chemical Division's chlor-alkali plant at Tacoma, Wash., the first perchlorethylene-producing plant in the Northwest and only the second such plant in the western United States.

Manufacturers' Literature

Batch Cleaning

Equipment Div., Magnus Chem. Co., Inc., Dept. MF, Garwood, N. J.

This 12-page, illustrated booklet discusses industrial batch cleaning in some detail, citing the efficiency of different methods and their effectiveness on parts that range in size from the smallest pieces to the great blocks of locomotive diesel engines.

Illustrated are standard-model Aja-Lif machines, special units, and individually designed and fabricated systems (multi-stage, walking beam, "merry-go-round") for specific batch-cleaning jobs.

Barrel Finishing

Tumb-L-Matic, Inc., Dept. MF, 65 St. Mary's St., Stamford, Conn.

A new, 4-page illustrated brochure describes in detail a complete line of barrel finishing compounds, abrasives, soaps and general media. In addition to an exhaustive listing of materials, the folder also includes information for use as a general guide in selecting the proper media for both wet and dry tumbling operations.

Plating Equipment

Enthone, Inc., Dept. MF, 442 Elm St., New Haven 8, Conn.

Equipment for plating, blackening, cleaning, pickling, chemical processing, waste disposal, and corrosion control is described and illustrated in a new, eight-page brochure.

Numerous illustrations are included depicting plastic exhaust hoods, ductwork, plastic-lined tanks, filters, plating racks, blackening barrels, console platers, acid buggies, etc. The brochure also contains a check list of over 50 items with an accompanying business reply card which can be used to request further information on any item.

Pneumatic Temperature Control

Burling Instrument Co., Dept. MF, 16 River Road, Chatham, N. J.

Bulletin 151-1 describes a differential expansion type pneumatic temperature control Model HA. Included are photographs, description of operation, and table of standard ranges, tube sizes, and performance.

Gold Spray Finish

Bee Chemical Co., Dept. MF, 2700P E. 170th St., Lansing, Ill.

A new folder describes Bronzeless Gold spray finish, which simulates the appearance of fine bronze powders. The folder gives product data on systems for metals and thermoplastics, shows color chips of standard colors and typical applications by appliance and electronic manufacturers.

Corrosion Computer

H. M. Harper Co., Dept. MF, Morton Grove, Ill.

A 4 in. by 8 in. card that works like a slide rule tells in seconds how each of eight types of metal withstands the corrosive effects of 141 chemical agents.

The metals are common in mechanical work, brass and naval bronze; silicon bronze; Monel metal; stainless types 410, 416, and 430; stainless types 302, 303, 304 and 305; stainless type 316; copper, and aluminum.

Plastic Valves

Walworth Co., Dept. MF, 750 Third Ave., New York 17, N. Y.

A new circular, describing plastic valves and fittings, has a comprehensive, 4-page application table that rates PVC's effectiveness on over 300 fluids. Another section gives illustrated descriptions and dimensions of valves, strainers, unions, fittings, and expansion joints.

Oscillating Belt Grinders & Sheet Surfacers

Service Mfg. Co., Dept. MF, 2363 University Ave., St. Paul 14, Minn.

Detailed description of Tri-Matic oscillating belt grinders, 12″ through 48″ sizes with specifications and typical applications plus an oscillating sheet surfacer using abrasive impregnated Nylon will be found in new brochure, TM860.

Hydraulic Jet Cleaner

Sellers Injector Corp., Dept. MF, 1600 Hamilton St., Philadelphia 30, Pa.

Bulletin 446 contains information on the installation, operation and maintenance of the "Super Booster" hydraulic jet cleaner.

A line drawing shows a typical unit installed, in relationship to supply lines and a detergent tank. Input and discharge conditions are listed tabular-

ly, including capacities in gallons per hour, pressures, and temperatures at discharge. The method of introducing detergent into the discharge stream is also explained.

Heat-Resisting Paint

Speco, Inc., Dept. MF, 7308 Associate Ave., Cleveland 9, Ohio.

A new 4-page engineering specification bulletin, ES-608, for Heat-Rem H-170 describes the material, its uses, composition, application and storage stability. In addition, it discusses results of various tests.

Vacuum Metalizing

Poly-Kote, Inc., Dept. MF, 82 Chestnut St., North Attleboro, Mass.

Custom vacuum coating services for functional and unusual decorative purposes are the subject of a new 4-page brochure. Described are coatings for abrasion corrosion, and high temperature resistance, as well as unusual electronic effects. Also mentioned are special processes for decorating materials, such as polyethylene, which do not readily lend themselves to conventional coating techniques.

Hard Chromium Services

Hardchrome Electroprocessing Corp., Dept. MF, 10 Vandewater St., New York 38, N. Y.

Bulletin No. 3 consists of an explanation of the advantages and limitations of hard chromium plating for manufacturers of machine parts, tools, and dies. Included are some statistics and case histories, with illustrations of typical rack construction for complex parts.

Automatic Spray Machine

Conforming Matrix Corp., Dept. MF, 349 Toledo Factories Bldg., Toledo 2, Ohio.

A new brochure, 2COR, is available on a high production automatic dial spray decorating machine. The brochure also describes two machines for fast wiping of parts.

Strip Mill Scrubber

Hanson-Van Winkle-Munning Co., Dept. MF, Church St., Matawan, N. J.

A two-page, two-color bulletin, No. SU-100 illustrates and describes various types of strip mill scrubbing equipment available from the company. Particular emphasis is given to an exclusive, patented quick-change brush feature.

The chief defect of Plater Smith

Was using nickel highly stressed.

At last he tried to plate some parts
That cracked, and peeled,
And fell apart.

Platers of the utmost fame
Were called at once,
But when they came,
They smiled, as they took their fee
There is a cure for this indeed!

Stress-free, ductile,
Sulfamate Nickel
Made by Barrett
Will end this pickle.

Now,
Plater Smith has changed his ways
He switched,
From old type nickel plate
Now uses only
Barrett Sulfamate.

Request Bulletin SN-2

BARRETT
chemical products company, inc.
Shelton • Connecticut

Other equipment described are the two brush, two backup sheet scrubber, the two brush, two backup plating line scrubber, four brush, four backup coating line scrubber and the four brush, two backup cleaning line scrubber.

Industrial Ovens

Catalytic Combustion Corp., Dept. MF, 4725 Fourteenth, Detroit 8, Mich.

This article discusses basic design methods for applying all-metal catalyst elements for air pollution control in a wide range of industrial ovens, furnaces and dryers. It tells how hazardous combustible exhaust fumes are converted to clean, safe, re-useable heat energy, by economical catalytic oxidation.

Plate Coils

Dean Products, Inc., Dept. MF, 1048 Dean St., Brooklyn 38, N. Y.

The uses of single and double embossed "Panelcoil" for heating and cooling are illustrated in their many extended applications on storage and processing tanks, drums, troughs, ovens and other processing equipment requiring heating or cooling.

Organic Finishes

Randolph Products Co., Dept. MF, Carlstadt, N. J.

A new 4-page folder describes available government specification finishes (primers, lacquers, enamels, dopes, and slushing compounds).

NEWS FROM CALIFORNIA

Ways and means of providing the Southern California area with a night school course in the fundamentals of electroplating are being given serious consideration this Fall. Such a course was offered for more than a dozen years by the Extension Division of the University of California. *Mitchel Raskin*, a well known Los Angeles plating supervisor and consultant, served as instructor of the course, until he transferred his activity to northern California a year or so ago. Last year a plating course was offered by Woodbury College of Los Angeles, with *Morrie Schwartz* of the Kelite technical staff, as instructor. That course is not being offered this year.

With no adequate course now available, leaders of Los Angeles Branch of the A.E.S. have been giving thought to how a course in plating could be re-established. The working out of details on how the course should be set and under whose sponsorship, has been delegated to a special committee created on September 14 by branch president *Frank Virgil*.

Mr. Schwartz, by virtue of his experience as instructor of an earlier course in Los Angeles, and instructor of a company class sponsored by Lasalco, Inc., in St. Louis, and for a Pittsburgh steel company, was named to the committee. *Horace Smith* of L. H. Butcher Co., was named president, and *Don E. Baudrand*, chairman of Los Angeles Branch's educational committee, and his assistants, *Dan Ross* and *William Pardee*, were appointed as ex-offico members of the night school sub-committee.

If none of the Southern California colleges — UCLA, USC, Occidental, Pepperdyne, Woodbury or Loyola, can be induced to sponsor the plating class, it was suggested that possibly a joint-sponsorship of Los Angeles A.E.S. branch and the Metal Finishing Suppliers Association could be worked out. The special committee has been instructed to evaluate the matter and report at the November general meeting of the branch.

Outfitting of a new factory building in Santa Ana, Calif., for the Studebaker-Packard Bell Corp. was nearly completed in mid-August with the installation of a 10 x 10 x 16 foot oven designed for curing and post-curing reinforced plastic parts for the space and missile fields.

The five-ton oven is equipped with the latest temperature controls and safeguards. The oven is so large that it had to be installed before the roof of the building could be put in place. The new plant is equipped for work on the thermal re-entry protection aspect of the Pershing missile under contract to the Martin Co.

Universally applicable problems in engineering and management will be considered by an audience of engineers

UP TO 48% GREATER EFFICIENCY!

IMPERIAL PLATING BARRELS

WITH NEW "FIN" DESIGN

An important "first" from Imperial! In actual tests against standard plastisol-coated steel plating barrels, an Imperial all-plastic barrel with the exclusive "fin" design *increased plating thickness 48%*. The secret is reduced electrical resistance and more thorough agitation and uniform circulation in the plating solution.

Imperial manufactures higher-efficiency plating barrels in a wide range of sizes, materials, and models. They are 100% interchangeable with the standard barrels on your automatic plating machines. Barrels illustrated are made of polypropylene (*first* used for barrels by Imperial several years ago) or COPOLEFIN—a special olefin copolymer. Features: Sturdy, all-welded and reinforced construction; great resistance to chemicals, stress, impact, abrasion, heat; long service life; light weight; and low cost. They stand up under all solutions and temperatures. The units are also available in high-temperature Plexiglas and other materials, on special order.

Imperial makes horizontal belt and gear driven barrels to fit your existing plating equipment, as well as plastic tanks, ducts, hoods, and other custom-fabricated parts.

All barrels are backed by years of manufacturing experience — plus a warranty. Write now for free literature.

IMPERIAL INDUSTRIES, INC.

4436 Walker Avenue • Wayne, Michigan

and managers for ten days beginning January 23, 1961, on the campus of the University of California at Los Angeles.

The University of California's Extension Division has issued invitations to representatives of every major country in the world to attend the 1961 conference, which will mark the seventh year the course has been given. Participants will have a choice of 23 subjects being taught by 30 professors, industry specialists and managerial consultants.

A polishing and sanding room and an extensive metallurgical laboratory are among the facilities included in a new 22,000 square foot plant opened recently in San Carlos, Calif., by the Pyromet Co., formerly located in South San Francisco.

The firm specializes in metallurgical services and metal processing and treating for the aircraft, missile, electronic and commercial metals industries.

The new plant is equipped with facilities for vacuum processing refractory metals which will not tolerate hydrogen or other atmospheres. For this purpose a specially designed vacuum furnace, said to be the only one of its kind on the Pacific Coast, has been installed, with which laboratory-like control of production cycles can be achieved. Also available are low and high frequency induction heaters, tempering, nitriding and mesh belt furnaces, and a dry hydrogen furnace.

Jack W. Knapp, buyer for Hooker Chem. Co.'s Western Chemical Division at Tacoma, Wash., has been transferred to the division's sales department.

"America's Success Through Manufacturing Engineering" was the theme of an engineering conference held at the Hotel Ambassador, Los Angeles, October 14 to 18 under the sponsorship of the American Society of Tool & Mfg. Engineers.

According to *H. E. Conrad*, executive-secretary, the conference was designed to afford a quick and efficient method of evaluating new developments, processes and products. An estimated 12,000 industrial executives, engineers and production men from eleven western states attended. Technical sessions were held in the Ambassador Hotel and a tool exhibit in the Los Angeles Memorial Sports Arena.

Dr. John S. Autenrieth, manager, marketing services, Hercules Powder Co., addressed the September 14 meeting of the Los Angeles Society for Coatings Technology on "The Effect of Polyol Structure on the Performance Characteristics of Alkyd Resins."

As a basis for discussion, Dr. Autenrieth reviewed typical film failures associated with exterior durability as well as conditions of breakdown where excessive heat for extended periods were responsible.

The speaker outlined raw materials associated with the manufacture of alkyds as dibasic acids, poly alcohols, fatty acids and the modifiers — rosin, styrene, etc. He presented an elementary ester breakdown mechanism by pyrolysis and described the specific resistance and stability of the neopentyl type esters to this type failure.

BUFFING COMPOUNDS

ABRASIVE BELTS
ABRASIVE GRAINS
FINISHING SUPPLIES
FINISHING EQUIPMENT
BUFFS
COMPOSITIONS
AND EMULSION
CEMENT, POLISHING
COMPOSITIONS
DEGREASERS
LACQUERS
FILTERING EQUIPMENT
RACK COATING MATERIALS
CONVERSION COATINGS
TEMPERATURE REGULATORS
ANODE BAGS
ANODE BASKETS
BACKSTAND IDLERS
BARREL
BARREL
BARREL, PLATING
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BUFFING AND POLISHING
DIP TANKS AND MACHINES
RUST PREVENTIVES
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RECTIFIERS
PERIODIC REVERSE EQUIPMENT
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ANODES
BASKETS, DIPPING AND HANDLING
BRUSHES, TAMPICO
BRUSHES, WIRE
CLEANERS, ALKALINE
COMMON CHEMICALS
TESTING EQUIPMENT, LABORATORY
ABRASIVE BLASTING EQUIPMENT
CROCKS AND DRUMS
ELECTROPLATING AND ANODIZING EQUIPMENT
FELT POLISHING WHEELS
GLOVES, RUBBER AND CLOTH
SALT SPRAY TESTING EQUIPMENT
SAWDUST AND MAIZE
WHEELS, POLISHING
CARBOY ROCKERS
COILS AND PLATES
ELECTRIC IMMERSION
POLISHING MACHINES, AUTOMATIC
TAPE
SCRATCH BRUSHES
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ULTRASONIC EQUIPMENT

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LEADING CANADIAN MANUFACTURER AND DISTRIBUTOR SINCE 1936
COMPLETE LINE OF PLATING AND POLISHING EQUIPMENT AND SUPPLIES

LEA PRODUCTS COMPANY
996 DE BULLION STREET MONTREAL, CANADA

25th year Since 1936

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Dallas-Fort Worth Branch

Some 60 A.E.S. branch members and their wives attended the first Fall meeting, Wednesday, Sept. 21, at Howard Johnson's Turnpike Restaurant. This meeting was especially important as it marked the first Annual Branch Banquet and the formal installation of 1960-61 branch officers.

President *Myron Browning* opened the meeting, after which the new officers were installed by *Frank Beuckman*, and incoming President *William Aves* took over the chair. *Dr. T. C. Franklin* presented data on Research Project #20. *M. E. Browning* gave the final report on the Aerospace Finishing Symposium held at Fort Worth. *A. C. Fricke* was the recipient of the First Annual Branch Achievement Award, given for his efforts in behalf of the branch over the years. Mr. Browning gave a report from the Los Angeles Convention on the formation of a Southwest Regional Conference which will aid members in scheduling speakers for the various branches. Delegates and alternates were selected for the 1961 Convention at Boston.

The branch was extremely fortunate in having two very excellent speakers for the evening: *Frank Beuckman*, National 3rd vice-president of the A.E.S., and *Ezra Blount*, editor of "*Products Finishing*" magazine. Mr. Beuckman discussed future aims of the A.E.S. Mr. Ezra Blount's talk on his trip to Japan proved very informative. He concluded his talk with a movie taken during his first visit to Japan eight years ago and contrasted some of the changes which have since taken place.

Drawings were held by *E. R. Rinehart* for both ladies' and men's door prizes, with *Mrs. J. Savoie* winning a lovely pair of earrings, and *Bill Teer* a tackle box.

Jack D. Haler,
Recording Secretary

San Francisco Branch

The monthly meeting was brought to order on Sept. 8 at 8:45 by *Guy Condrott*, president. There were 45 members present. The following guests were introduced:

Jan Hanfield, Wyandotte Chem. Co.; *Chaplin Hever*, U. S. Army; *Gary Winnick*, L. H. Butcher Co.; *Jack Sullivan; Peter Rollason*, Printronics; *Paul Ignacz*, Fairfield Semi Conductor.

Dick Mitchem, librarian, introduced the speaker, *Ezra Blount*, editor of *Products Finishing* magazine, who spoke on "Metal Finishing in the Far East." Following the speech, there was an enthusiastic question and answer session.

The following points were discussed during the regular business meeting: *Stan Bammann* reported on final details at the annual picnic to be held Sunday, Sept. 25, at Laurel Park. *Bill Ferry* reported on his electroplating course to be given each Tuesday night at 7:00 P.M. to 9:00 P.M., commencing on Sept. 20 at Cubberly High School, 4000 Middlefield Road, Palo Alto. Entrance fee will be $3.00. The program will be of the apprentice training type on high school level prerequisite.

Harold Smallman reported on the financial progress of the Suppliers' Contribution Fund.

C. E. Snelgrove
Secretary-Treasurer

Phoenix Branch

The first fall meeting was held at the Interlude Club, Thursday, Sept. 15. This meeting was held on Thursday instead of the usual Tuesday night to enable the speaker, *Ezra Blount*, editor of *Products Finishing*, to meet with us.

Floyd Huhn, president, opened the business meeting at 8:00 p.m., welcoming three guests, *Walt Walzak*, Sel-Rex Corp., *Willard Bell*, Chemical Research Co. and *Al Wellman*, Goodyear Aircraft.

Dr. Clyde Crowley, head of the nominations committee submitted the following slate for 1960-61 officers:

President — *Floyd Huhn*
First Vice President — *James Weaver.*
Second Vice President — *John Mullarkey*
Secretary — *Paul Wible*
Librarian — *Robert Hays*
Treasurer — *Neva Johnson*
Board of Managers — *Clyde Crowley, Paul Madden* and *William Bath*

Approval was granted by the membership.

Mr. Weaver then appointed *Joseph Motil* to serve as sergeant-at-arms for the year.

Mr. Blount described his visits to the Japanese plating industry and showed a color movie of hard chromium plating. Two applications for membership were submitted to the board of managers.

Paul M. Wible,
Secretary

Newark-New York Branches

President *John Banta* called the Second Metropolitan Regional Meeting to order at 8:30 P.M., on Sept. 16. One hundred and eighty members and guests of both the New York branch and the Newark branch were in attendance. Membership representation of each branch was about equal. Roll call of the officers of both branches was made and all were present.

DEPENDABLE PPI PRODUCTS

RUBBER AND PLASTIC DRUM LINERS
MONEL, STEEL, COPPER AND TITANIUM ANODE HOOKS
PLASTIC COATED PAILS AND DIPPERS
POLYETHYLENE TANKS AND PAILS
TITANIUM ANODE SCRAP SAVER BASKETS
TITANIUM HEATING COILS
TRICHLORDETHYLENE
PERCHLORDETHYLENE
SILVER BRIGHTNER
SWIMMING POOL CHEMICALS
OIL ABSORBENT
ACID TANKS AND CONTAINERS
HAND CHEMICAL PUMPS

New Formula . . . . . .

SILVER-BRITE

FOR USE IN SILVER PLATING SOLUTIONS

PPI has developed a silver brightener under the trade name "Silver-Brite". It is simple to use and now makes it possible for you to deposit .005" of uniform silver plate per hour or .0005" of silver plate in 5 minutes.

Advantages . . . . .

- Uniform and smooth deposit
- Semi-bright plate
- Fast rate of deposition
- Will not decompose in use
- Economical in cost per gallon

Silver-Brite is simple to use and will increase your silver plating efficiency. Many companies have used it for plating as high as .040" silver on bearings. Others have used it for thin bright commercial deposits.

PPI Silver-Brite
Stock No. 1-SB

Quantity	Price
1 gallon	$5.00
5 gallon (per gal.)	4.50

PLATING PRODUCTS, Inc.
1309 N. WASHINGTON
KOKOMO, INDIANA

Mr. Banta presented *Dr. W. A. Wesley*, president of the National Society, who expressed in a few words the merits of regional meetings. He suggested that perhaps this regional meeting could be expanded to include some of the other nearby branches.

A moment of silence was observed in tribute to *Gus Munning* who passed away this Summer.

It was announced that *Dave Clarin* is retiring, and he was given a chance to tell of some of his early experiences as a member of this Society. He did this in his inimitable humorous style. Dave was given a standing ovation.

The second Lou Donroe Award was presented to *Mario DiChiara* for his timely topic on anodizing of aluminum. It was suggested that he should expand his subject to a full lecture. The plaque for the award has been standardized. In view of this, it was decided to present last year's recipient, *Jim Shyne*, with the new plaque.

Librarian *Cy LaManna* then presented Mr. Marzano whose subject was "How to Plate Difficult Metals." He outlined specifically the procedures which he found satisfactory, and discussed alternate procedures which others preferred. Needless to say, many questions were asked and before long many people either volunteered or were called upon to express their views.

The second speaker of the evening was *Dr. A. Kenneth Graham* whose subject was "Fundamental Considerations in Electrocleaning." He showed how Faraday's Law effected good electrocleaning and electropickling, an excellent presentation in that it was a good review for the old timers, and an enlightening presentation to those new in the art of cleaning or plating.

Both speakers were given a resounding vote of thanks and the meeting adjourned to partake of beer, cheese and crackers. This gave members of both branches a good chance to renew old acquaintances.

Gustav Bittrich,
Assistant Secretary

Rochester Branch

The Rochester branch opened its 1960-1961 season with a victory smorgasbord in honor of *Frank Beuckman's* election as third vice-president of the national society, at the Rochester German Club on September 12th. After the members present had eaten their fill, the powerful gavel of prexy *John Cipolla* brought the business meeting to order.

Mr. Beuckman gave a very interesting and enlightening talk on the results of the national convention.

After the applause finally died, Mr. Cipolla presented the new officers of the branch, as follows: *John Cipolla*, Pres.; *Charles Fedeor*, 1st V.P.; *William Elston*, 2nd V.P.; *Loring Carson*, Librarian; *E. A. Pottridge*, Treasurer and Acting Secretary.

The meeting was concluded after Mr. Bueckman was presented with a scroll signed by the membership, to wish him success in his new venture.

E. A. Pottridge,
Acting Secy.

Detroit Branch

The branch had its monthly meeting on October 7 at the Michigan Room, at the Statler-Hilton Hotel. This was a meeting devoted to the subject, "Cleaning Symposium." *Bruno Leonelli* was the technical chairman.

The speakers were: *Dr. A. Lloyd Taylor*, MacDermid, Inc.; *B. J. Schotten*, Northwest Chem. Co.; *E. J. Kubis*, Wyandotte Chemicals Corp.

W. G. Anderson

Chicago Branch

The members met, for the first session of the 1960-61 season, on Friday, Sept. 9 at Petricca's Restaurant, 510 North Western Ave. This site was selected by the board of managers for future meetings during the year. *Matt Dassinger*, president, gave a brief report on the golf outing which was held at the Glendale Country Club. The "outing" was successful and everyone is looking forward to next year's outing. *Si Gary*, librarian, discussed the speakers for the next two meetings. *Dr. Mendizza*, Bell Labs., will speak on "Corrosion Problems" and *Art Bartman*, in November, will be the chairman of a panel on "Organic Coatings."

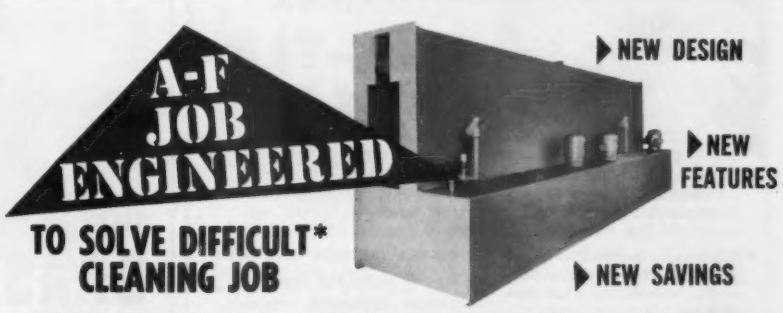
Si introduced *Don Morris* (HVWM Co.), who acted as chairman of the panel which discussed the subject of "When to Automate." The panel members were *Larry George* of Udylite Corp., *William Geissman* of National Lock Co. and *Vincent Mattacotti* of Milwaukee Plating. There was a general agreement that, on a simple plating line where the cycle has a few cleaning dips, a hoist line will suffice. An automatic is required where the cycle is complicated and has a number of tanks for cleaning and preparation of the metal before plating. All the members enjoyed the panel discussion and were given a rising vote of thanks for their interesting discussion.

Christopher Marzano
Publicity Chairman

Buffalo Branch

The branch held its first meeting of the new season on Sept. 9 at the Niagara Manor in Buffalo, N. Y. with 35 in attendance. *John Donaldson* introduced the guests of the evening: *Donald Hutchison* from Harshaw Chem. Co. and *Dr. William Sheridan* from Sylvania.

Mr. Donaldson advised the branch is attempting to increase membership



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by at least 10% in accordance with a request from national headquarters. He has prepared a unique membership flow chart showing increase in per cent of membership. The committee assisting Mr. Donaldson consists of the following members:

George Wolf, Eric Sampson, Robert Potter, William Bishop, Simon Bush, Stanley Bush, Donald Pembridge, George Bartle.

Chuck Fotheringham was appointed chairman of the forthcoming annual Christmas Party and will be assisted by Messrs. *Daniel Stackowiak* and *Mel Stachura.*

Buffalo Branch members in attendance at the Los Angeles Convention were: *Mrs. Joan Wiarda, Robert Castle, Ralph Stemmerich.*

A motion was made, seconded and voted on favorably that Buffalo formally bid for the 1967 Convention.

After the business session, Librarian *John Tiebor* introduced the speaker of the evening. *A. C. Benning*, sales manager of electroplating process sales and field technical service for Harshaw Chem. Co., presented an interesting and informative talk on duplex nickel, particularly in its application to zinc die cast plating.

The third speaker of the year, scheduled for November 4, will be *C. M. Weege, Jr.*, of Industrial Filter & Pump Mfg. Co. His subject is filtration of electroplating solutions.

Robert C. Eich,
Secretary

Dayton Branch

The branch opened the season with a regular meeting on Sept. 21 at the Biltmore Hotel with 38 present. Among the visitors introduced were *Tom Hackett* of Delco Products, *Jim Lever* of Wright Field, and *Bob Wiedemann, Dick Evans* and *Stu Chipman*, all of the Cincinnati Branch.

The chairman of the membership committee, *Bob Fisher*, announced plans for a membership drive and asked every one to assist by bringing interested visitors to the meetings.

Walter Anderson, librarian, outlined the program for the year which includes a fine variety of well known speakers. He mentioned particularly that *Dr. W. A. Wesley* will be honorary chairman of the 15th. Annual Educational Session and Dinner Dance at the Hotel Biltmore on March 4, 1961. *Lawrence Hadlock* is the general chairman of this affair.

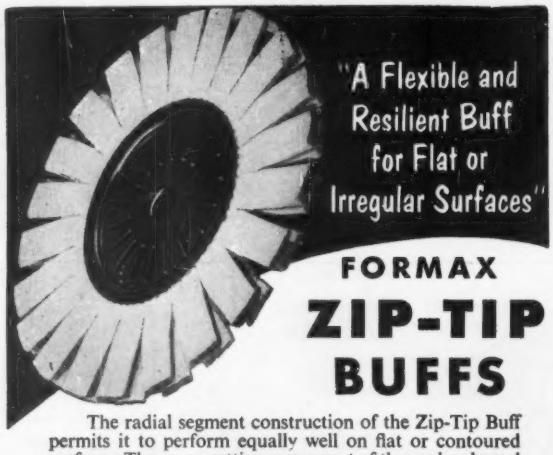
The featured speaker of the evening was *Kenneth Bellinger*, president of Conversion Chem. Corp. of Rockville, Conn. His subject "Trouble Shooting in the Plating Room" was based on more than twenty years experience in this field.

Following the meeting refreshments were served through the courtesy of the F. B. Stevens Co. and their local representative, *Harry Brown.*

L. A. Critchfield,
Publicity Chairman

Blue Ridge Branch

The regular monthly meeting was held Sept. 9, in the State Room of the Hotel Robert E. Lee in Winston-Salem, N. C. Thirty-one members and guests attended the meeting. Branch President *Bruce E. Wallace* presided over the business meeting, at which *T. R. Boggess* was presented with a past president pen. The second item of business was the election of delegates for the coming year. Those elect-



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ed were: *T. R. Boggess, Donald McGee,* and *Mike Milo.* The alternates are *Dr. Nelson Murphy* and *Howard Welfare.*

Seven new members were elected. They are: *Ernest Arsenault, Norman Lewis, John Finnigan, John Benjamin, John Pope, Leonard Breau* and *T. C. Williams.*

After the business meeting, *Clem Hohner* introduced *Dr. R. B. Saltonstall,* of Udylite, who presented a talk on "Agitation in Electroplating." His talk covered the history of agitation of electroplating solutions in both the United States and England. The various methods of agitation were discussed. The talk also covered the many reasons for agitating plating solutions.

Donald H. McGee,
Secretary

Waterbury Branch

The Branch opened its 1960-61 season with its September meeting at the Roger Smith Elton Hotel. President *William Giesker* called the meeting to order at 8:00 P. M., and announced that the following appointments had been made at the recent business meeting: The executive board appointed *Francis A. Schneiders,* publicity, and *Clarence Foster,* assistant librarian. President Giesker appointed *Raymond Mitchell* research chairman. Certificates of membership were awarded by Secretary *James Kennedy* to new members *Thomas Giampetruzzi* and *Frederick Gavigan.*

Technical Chairman *Donald Mencio* introduced the speaker of the evening, Trooper *George Zonas* of the Connecticut State Police. His subject was "The Present State Police Enforcement Program and Highway Safety." It was an excellent and thought provoking presentation of the problems and the efforts to overcome the problems of traffic safety.

The meeting was followed by refreshments.

F. A. Schneiders
Publicity

Southeastern Branch

The branch kicked off its new season again in competition with football games for attendance. The meeting was held Sept. 9 at the Architects and Engineers Institute in Atlanta. Low attendance was attributed partly to sickness and death in several members' homes. *Louis Rosenberg's* wife passed away earlier in the week. *H. R. Stogner's* mother was critically ill in a local hospital. President *Myron M. Randman* was in St. Joseph Hospital recovering from a recent serious illness.

Bob M. Taylor presided over the small informal group which had gathered for the first meeting of the new season. After dinner and a short business session, *Dave Griffin* presented the speaker. A very interesting informal discussion was held with *Alfred M. Weisberg* of Technic, Inc., on Precious Metals Plating.

Under the program direction of *George W. Taylor,* the branch expects to have an increase from meeting to meeting. George has been fitting together a very interesting program for the year.

Robert R. Probert
Assistant Secretary

Los Angeles Branch

Los Angeles Branch, at its September 14 meeting, voted approval of a recommendation of a special committee to join with five other western branches in the formation of the Educational Council of Far Western Branches. The

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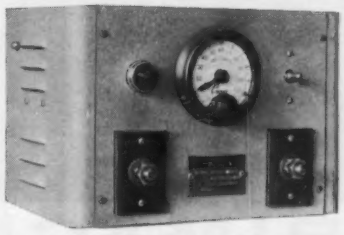

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recommendation was made by *Norman McEwan*, chairman of a committee appointed earlier this year, to confer with representatives of other branches on the organization of a Western Regional Group.

McEwan reported that branch representatives met at the Statler Hotel, Los Angeles, on July 28 during the national convention. Present were representatives of Los Angeles, San Francisco, Portland, Phoenix, Seattle, Portland, and the newly organized San Diego Branch.

While no specific sentiment was revealed relative to the formation of a regional group of branches for purposes of holding western regional technical conferences, the branches were in favor of a collaborative arrangement that would serve to provide better speakers at monthly meetings.

The representatives agreed that an arrangement that would enable an eastern or mid-western speaker to address a number of Far West Branches on the same trip would be beneficial to the speakers as well as the branches. To this end, McEwan reported, the representatives recommended the formation of the Educational Council of the Far West. The educational committee chairman of each branch involved would be a member of the Council, with *Don E. Baudrand*, chairman of Los Angeles Branch's educational committee, as council chairman.

McEwan reported that a schedule of meeting dates was worked out so that each branch would hold its monthly meeting on a night different than any other. If that schedule is adopted and adhered to, McEwan said, a speaker could make the western "swing" and appear before five or six western branches within a matter of a week or ten days, and be assured of no conflict in meeting dates.

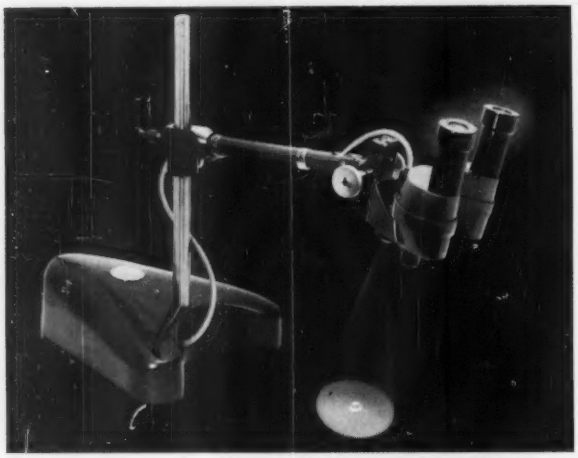
The proposed meeting days of each branch are as follows: San Diego Branch, second Tuesday of each month; Los Angeles, second Wednesday; San Francisco, second Thursday; Portland, third Tuesday; Seattle, third Wednesday; Vancouver, third Thursday.

McEwan also emphasized that each branch would be free to accept or reject a speaker. But it was felt, McEwan said, that most speakers would be acceptable to enough of the branches to make it worth his while to come west.

Approval of members of Los Angeles Branch was unanimous.

The September 14 meeting, first in the Branch's series of fall sessions, was attended by 85 members and guests. *George Hetz*, co-chairman of the recent national convention committee, gave his final report. *Francis T. Eddy*, past-national president, now a member of Los Angeles Branch, expressed the opinion that the Los Angeles convention was one of the best arranged that he had ever attended. Eddy also spoke in favor of the proposed Educational Council of Far Western Branches, stating that, in his opinion, most speakers would be heartily in favor of a plan that would enable them to address several branches on the same trip west.

The speaker at the educational session of the meeting was *Ezra A. Blount* of Cincinnati, editor of *Products Finishing* magazine. He spoke on "Recent Survey of the Japanese Plating Industry," basing his talk on developments in the Nipponese finishing industry that have come about since a



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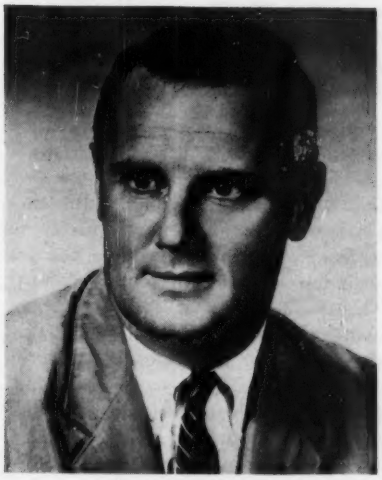
paper of his on the same subject was read before Los Angeles Branch in 1956.

N.S.P.F.A.

Kenneth B. Sharpe, executive vice-president, *Sharpe Mfg. Co.*, leading West Coast manufacturer of spray painting equipment, has recently been elected president of the *National Spraying Painting and Finishing Assn.*



Kenneth B. Sharpe

by an agreement of the association members.

In addition to Sharpe, other newly elected association officers are *Frank R. Ritt, DeVilbiss Co.* of Toledo, Ohio, secretary and *Clyde E. Small*, Campbell-Hausfeld Co. of Harrison, Ohio, treasurer.

N.A.M.F.

Napoleon A. Vigeant, president of M & V Electroplating Co., Newburyport, Mass., has been named general chairman of the 1961 convention committee of the National Association of Metal Finishers. Vigeant, who heads one of Mass.' largest metal finishing firms, will be responsible for planning and implementing a 4-day conclave scheduled to be held in Boston, June 16, 17, 18, and 19, 1961. Headquarters hotel is the Statler-Hilton.

Simultaneous with his appointment, Vigeant named the following to his committee: *W. F. Acks*, American Anodizing Corp., Quincy, Mass.; *H. Saltzberg*, Modern Electroplating Co., Roxbury, Mass.; *Leo Rosenberg*, Reliable Silver Inc., Sommerville, Mass.; *F. R. Davino*, Plating for Electronics, Waltham, Mass.; *C. White, J. Wright, E. C. Callahan*, F. M. Callahan & Son, Malden, Mass.; *H. Levy*, American Electroplating Co., Cambridge, Mass.; *B. Warner*, New England Plating Co., Worcester, Mass.; *W. F. Walton*, Walton & Lonsbury, Attleboro, Mass.; *V. Campisi*, Watertown Chrome Plating Co., Watertown, Mass.; *Dr. G. P. Swift*, Watertown, Mass.; *J. L. Shields*

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and *M. Plummer*, Maine Metal Finishing Co., So. Gorham, Me.; *A. W. Logozzo*, Nutmeg Chrome Corp., West Hartford, Conn.; *C. V. Hickey*, HarConn Chrome Co., West Hartford, Conn.; *C. T. Smith*, Electronics Metal Finishing, Brookfield, Conn.; *S. H. Lowell*, Lowell Plating Works, Needham Heights, Mass.; and *W. Hearney*, Tremont-Old Colony Plating, Boston.

Mr. Vigeant started his career in the metal finishing field at Towle Mfg. Co., Newburyport, Mass. In 1947 he started his own business when he converted one of Bossy Gillis' garages into a plating plant. From less than half dozen workers then, his firm has grown to close to 100, the largest metal finishing firm on Mass.' North Shore. Prior to his going into business for himself, he was plant supt. of Slocum Industries, also of Newburyport, Mass.

Active in many civic, church and community organizations, Vigeant has held the chairmanship of Newburyport's Economic Development Commission since 1954. He is on the local YMCA board of directors and serves as chairman of its finance and boys and girls division committees. Vigeant is also active with the Howard Benevolent Society; Board of Directors, Newburyport Civic League; and chairman of the Central Congregational Church religious education committee.

A.S.T.M.

Thomas A. Marshall, Jr., has been elected executive secretary of the *American Society for Testing Materials* by its board of directors. He is currently senior assistant secretary of the *American Society of Mechanical Engineers.*

Mr. Marshall was born in Savannah, Ga., in 1911 and received his early education there. In 1932 he was graduated from Georgia Institute of Technology (then Georgia School of Technology) with a BS degree in Aeronautical Engineering.

From 1932 until 1951, except for five years active duty with the U. S. Navy during World War II, Mr. Marshall was employed in the main office of the Metropolitan Life Insurance Co., first in various capacities in stationary engineering and later in posts of increasing responsibility in the Coordination Division.

In 1951, Mr. Marshall became Executive Secretary of the Engineering Manpower Commission which had just been formed by Engineers Joint Council and a year later became Secretary of EJC as well.

Mr. Marshall joined the staff of ASME in 1954 to manage the Society's 75th Anniversary Celebration and its public relations activities. In 1956 he was named Head of Technological Service, leading to his appointment as Assistant Secretary and, later, Senior Assistant Secretary.

NEW BOOK

Management Manual

Edited by E. N. Marlette, P. P. Kovatis & I. W. Marcovitch. Published by The National Association of Metal Finishers, 11 Park St., Montclair, N. J. 1960. Price: $25.00.

Although this loose-leaf compilation of data is only for the confidential use of members of the NAMF, the section on determinating and estimating costs alone is sufficiently valuable to warrant a company's joining the association in order to obtain a copy. This is a phase of metal finishing concerning which very little information has been available, although of equal importance to the manufacturer with a plating department and to the job shop. The section contains samples of typical profit and loss statements, and surveys of operating costs, wages and salaries, in addition to guides and methods of cost determination.

Other sections dealing with ethical practices and trade customs, sample standard forms and records of all types, and plating specifications and

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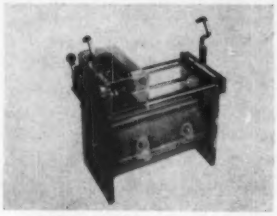

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CALENDAR

Nov. 8-11: First National Exposition and Congress, Society of Die Cast Engineers, Detroit Artillery Armory, Detroit, Mich.

Nov. 16-18: 22nd Annual Shop Practice Forum, Porcelain Enamel Institute, University of Illinois, Urbana, Ill.

Dec. 17: Annual Banquet and Christmas Party, Newark Branch, A.E.S., Robert Treat Hotel, Newark, N. J.

Jan. 17-18: Annual Meeting and Conference, Society of Vacuum Coaters, Lake Towers Motel, Chicago, Ill.

Feb. 3-4: 3rd Annual Dixie Regional Technical Session, A.E.S., Blue Ridge Host Branch, Hotel Roanoke, Roanoke, Va.

Feb. 4: Annual Educational Session and Banquet, New York Branch A.E.S., Statler-Hilton Hotel, New York, N. Y.

Feb. 4: 7th Annual Tri-State Regional Meeting, A.E.S., Deshler-Hilton Hotel, Columbus, Ohio.

Feb. 11: 8th Interim Meeting, Supreme Society, A.E.S., New England Regional Council, Host, Statler Hotel, Hartford, Conn.

Mar. 20-24: 12th Western Metal Congress and Exposition, American Society for Metals, Pan-Pacific Auditorium, Los Angeles, Calif.

Apr. 22: 22nd Annual New England Regional Meeting, A.E.S., Hotel Statler, Hartford, Conn.

June 18-23: 48th Annual Convention, A.E.S., Boston Host Branch, Boston, Mass.

standards, are of enormous value to the business man, comprising the accumulated experience of numerous metal finishing executives. For the production and estimating departments, there are included a very large variety of technical tables and charts which, although not original, are at least available in a single volume, which is very conveniently tab-indexed for quick reference.

The loose-leaf construction of the manual is very sturdy and has the advantage that further material, in process of preparation, can be inserted when available. The first of these will be sections on public relations and personnel practices, scheduled for completion during the next few months.

OBITUARIES

CLARENCE BLUMOEHR

Clarence Blumoehr, 58, assistant to the president of *Phelps Dodge Copper Products Corp.*, died suddenly at his home in Staten Island early Sept. 26.

Mr. Blumoehr started his career in 1918 with Habirshaw Cable and Wire Corporation, which was later acquired by Phelps Dodge. During the Korean War he was director of the Wire Mill Branch, Copper Division, of the National Production Authority, in Washington. After the end of hostilities, he was a consultant on many occasions to the Copper Division and was a member of the Executive Reserve of the Department of Commerce.

Mr. Blumoehr is survived by his widow, Mrs. Mary K. Blumoehr; two daughters, Mrs. Leonard N. Ogren of Staten Island and Mrs. Ronald C. Morse, East Orange, New Jersey, and two grandchildren.

JOSEPH V. BORLAND

Joseph V. Borland, vice-president, *Watson Standard Co.*, Pittsburgh, Pa., died at his home in Mt. Lebanon, Pittsburgh, Pa., at 11:15 p.m., Wednesday September 14, 1960.

Mr. Borland was widely known in the technical coatings industry. He is survived by his widow, Margaret Robinson Borland; two sons, Joseph V. Jr., and Kirk Robinson; and a sister, Mrs. Elizabeth K. Watson of Pittsburgh.

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2—Acme B-10
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4—Rapid 500 amp. 6 v. S.C. Full Control
1—R.A. 500 amp. 9 v. S.C. Full Control
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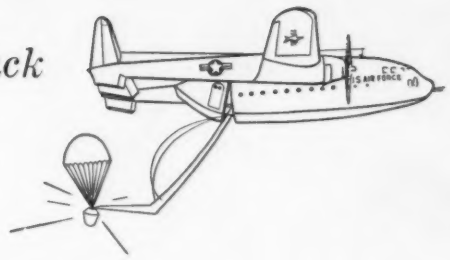
Handy & Harman
82 Fulton St., New York 38, N. Y.
Hanson-Van Winkle-Munning Co. 10, 11, 30, 68, 69, 79
Matawan, N. J.
Hardwood Line Mfg. Co. 110
2022 N. California Ave., Chicago 47, Ill.
Harshaw Chemical Co., The 6
1945 E. 97th St., Cleveland 6, Ohio
Heatbath Corp.
Springfield 1, Mass.
Heil Process Equipment Corp.
12914 Elmwood Ave., Cleveland 11, Ohio
Holland & Sons, Inc., J.
478 Keap St., Brooklyn 11, N. Y.
Hooker Chemical Corp.
1310 Union St., Niagara Falls, N. Y.
Hull & Co., Inc., R. O. 16
1300 Parsons Ct., Rocky River 16, Ohio
Ideal Chemical Co. 113
1499 Dean Dr., So. Euclid 21, Ohio
Illinois Water Treatment Co. 86
840 Cedar St., Rockford, Ill.
Imperial Industries, Inc. 102
4436 Walker Ave., Wayne, Mich.
Indust Plastics Div., Industrial Sheet Metal Works 7
4025 Bergen Turnpike, N. Bergen, N. J.
Industrial Filter & Pump Mfg. Co. 15
5906 Ogden Ave., Cicero 50, Ill.
Infilco, Inc.
P. O. Box 5033, Tucson, Ariz.
International Nickel Co., Inc.
67 Wall St., New York 5, N. Y.
Jelco Finishing Equipment Corp.
153 E. 26th St., New York 10, N. Y.
Kelite Corp. 90
81 Industrial Rd., Berkeley Heights, N. J.
Kinney Vacuum Div., The New York Air Brake Co.
3532 Washington St., Boston 30, Mass.
Koch Sons, Inc., George
10 S. 11th Ave., Evansville 4, Ind.
Kocour Company 28
4802 S. St. Louis Ave., Chicago 32, Ill.
Kosmos Electro-Finishing Research, Inc.
140 Liberty St., Hackensack, N. J.
Kushner, Dr. Joseph B. 111
621 S. Norman, Evansville 14, Ind.
Lasalco, Inc. 25
2820-38 LaSalle St., St. Louis 4, Mo.
Lea Mfg. Co. 35
16 Cherry Ave., Waterbury 20, Conn.
Lea-Michigan, Inc.
14459 Wildemere, Detroit 38, Mich.
Lea Products Co. 103
996 De Boullion St., Montreal 15, Quebec, Can.
Lea-Ronal, Inc. 36
139-20 109th Ave., Jamaica 35, N. Y.
L'Hommedieu & Sons Co., Chas. F. 5
4521 Ogden Ave., Chicago 23, Ill.
Lindale Equipment & Supply Corp. 112
504 Smith St., Brooklyn 31, N. Y.
Lindberg Products Co. 110
P. O. Box 908, Lakeport, Calif.
Macarr, Inc. 107
4360 Bullard Ave., Bronx 66, N. Y.
MacDermid, Inc. Back Cover
Waterbury 20, Conn.
Magnus Chemical Co., Inc. 83
11 South Ave., Garwood, N. J.
Manhattan Rubber Div., Raybestos-Manhattan, Inc. 24
6 Willett St., Passaic, N. J.
Meaker Co., The
Sub. of Sel-Rex Corp., Nutley 10, N. J.
Mearl Corp., The
41 E. 42nd St., New York 17, N. Y.
Metal & Thermit Corp. 26, 42
Rahway, N. J.
Michigan Buff Co., Inc. 114
3503 Gaylord Ave., Detroit 12, Mich.
Michigan Chrome and Chemical Co. 33
8615 Grinnell Ave., Detroit 13, Mich.
Motor Repair & Mfg. Co., The 113
1555 Hamilton Ave., Cleveland 14, Ohio
Munning & Munning, Inc. 98
202-208 Emmett St., Newark 5, N. J.
Murray-Way Corp.
P. O. Box 180, Maple Rd. E., Birmingham, Mich.
Neilson Chemical Co. 88
2326 Gainsboro, Ferndale 20, Mich.
New York Air Brake Co., Kinney Vacuum Div.
3532 Washington St., Boston 30, Mass.
Northwest Chemical Co.
9310 Roselawn Ave., Detroit 4, Mich.
Oakite Products, Inc. 8, 9
18 Rector St., New York 6, N. Y.
Packer Machine Co.
456 Center St., Meriden, Conn.
Pall Corp. 34
30 Sea Cliff Ave., Glen Cove, N. Y.
Parker Rust Proof Co. 4
2167 E. Milwaukee, Detroit 11, Mich.
Pesco Plating Equipment Corp. 113
75 Wythe Ave., Brooklyn 11, N. Y.
Pfizer & Co., Inc., Chas.
630 Flushing Ave., Brooklyn 6, N. Y.
Phelps Dodge Refining Corp.
300 Park Ave., New York 22, N. Y.
Plating Products, Inc. 104
1509 N. Washington, Kokomo, Ind.
Plating Service & Equipment Corp. 112
3620 Hart St., Detroit 14, Mich.
Randolph Products Co.
92 North 12th St., Carlstadt, N. J.
Ransburg Electro-Coating Corp.
3939 W. 56th St., Indianapolis 23, Ind.
Rapid Electric Co. Inside Front Cover
2881 Middletown Rd., Bronx 61, N. Y.
Raybestos-Manhattan, Inc. Manhattan Rubber Div. 24
Passaic, N. J.
Reliable Industrial Equipment Co. 114
633 Richmond St., Grand Rapids 4, Mich.
Robertshaw-Fulton Controls Co., Fulton Sylphon Div.
Knoxville 1, Tenn.
Rona Pearl Corp., Div. Rona Laboratories, Inc.
E. 21st & E. 22nd Sts., Bayonne 3, N. J.
Sandoz, Inc. 37
61 Van Dam St., New York 13, N. Y.
Schaffner Mfg. Co., Inc. 28
22 Herron Ave., Emsworth, Pittsburgh 2, Pa.
Sel-Rex Corp. Inside Back Cover
75 River Rd., Nutley 10, N. J.
Servi-Sure Mfg. Co.
131 N. Green St., Chicago 7, Ill.
Sethco Mfg. Co. 97
2286 Babylon Turnpike, Merrick, L. I., N. Y.
Sommers Bros. Mfg. Co. 111
3439 No. Broadway, St. Louis 7, Mo.
Stevens, Inc., Frederic B. 14
1808 - 18th St., Detroit 16, Mich.
Stutz Co., The
4430 W. Carroll Ave., Chicago 24, Ill.
Surety Rubber Co.
Carrollton, Ohio
Technic, Inc. 41
88 Spectacle St., Cranston, R. I.
Trerice Co., H. O.
1420 W. Lafayette Blvd., Detroit 16, Mich.
True Brite Chemical Products Co. 106
P. O. Box 31, Oakville, Conn.
Tumb-L-Matic, Inc.
St. Mary's St., Stamford, Conn.
Turco Products, Inc. 92
24600 So. Main, Wilmington, Calif.
Udylite Corp., The 87, 89, 91, 93
Detroit 11, Mich.
Unit Process Assemblies, Inc.
53-15 37th Ave., Woodside 77, N. Y.
U. S. Stoneware 17
Akron 9, Ohio
Unitron Instrument Co., Microscope Sales Div. 96
66 Needham St., Newton Highlands 61, Mass.
Univertical Corp.
14841 Meyers Rd., Detroit 27, Mich.
Vycote Co.
P. O. Box 6893, Journal Sq. Sta., Jersey City, N. J.
Worthy Products Co. 114
Box 1432, Boca Raton, Fla.
Wyandotte Chemicals Corp. 23
Wyandotte, Mich.
Zialite Corp. 108
92 Grove St., Worcester 5, Mass.

finding the golden needle in the haystack



(Top right) *sketch illustrates mid-air catch of returning Discoverer XIV nose cone snagged by an airplane-towed "skyhook."* (left) *A captured practice capsule is slowly reeled towards the rear opening of airborne C-119 Recovery Plane.*

NOSE CONES PLATED WITH SEL-REX BRIGHT GOLD* RECOVERED FROM SPACE ORBITS!

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(Above) *President Eisenhower holds American flag which was in recovered capsule during its flight through space. Capsule shown was electroplated with patented Sel-Rex Bright Gold Process. With the President are General Thomas D. White, Air Force chief* (center) *and Col. Charles G. Mathison, who directed the "capsule chase."*

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